

# POSITION PAPER TROLLEYBUS

Regarding the EU-directive on the allocation of public service contracts for passenger service.



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## **Introduction: Preface:**

In 60 European cities the trolleybus takes over the major part of the ÖPNV, the local public transport. This system of local public transport is especially popular among customers and local residents because of its environmental compatibility and it is increasingly esteemed by traffic analysers and transport companies due to its high customer acceptance, its „relatively“ low costs for construction compared to classical suburban railway transport systems, due to the „trolleybus bonus“, i.e. higher utilization through customers as compared to comparable bus systems and due to its excellent environmental compatibility and its acceptability by local residents.

Because of its technology, technical development and the infrastructural requirements the trolleybus can be classified as a railway transport system like suburban railway or underground. This classification should be taken into consideration in the regulations and directives of the European Union. The environmental aspect must not be neglected, as the ambitious goals of the Kyoto agreement regarding exhaust emissions call for innovative approaches in the organization of the local public transport. Such an approach can certainly be found in the mature and reliable technology of the trolleybus.

Dr. Heinz Schaden  
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## 1. Historical development:

Only a few years after the first electrical tramway started to operate in Berlin, the first trolleybus was put into service in the same town in 1882, then called „railless“ tram. At first this transport system was coming along very slowly because of bad road conditions and poor tyres. A short heyday all over Europe before World War I could be revived only in the thirties of the 20<sup>th</sup> century. The „railless“ tram, called trolleybus in most of the countries and languages in the world, turned into a sister system of the suburban railway because of its technology and the applied legal enactments.

In 2004 360 cities all over the world are using this ecofriendly transport system, employing 41.000 trolleybuses. In the European Union the trolleybus is the mainstay of urban public transport in 60 cities, but more cities are expected to put trolleybuses into service (e.g. Rome is going to take up service again in autumn 2004). In addition Switzerland is running 14 trolleybus companies and the Swiss are among the leading countries in trolleybus technology.

## 2. Systems engineering

Compared to suburban railway systems the trolleybus offers cost-effective infrastructural facilities. In comparison with conventional bus systems the structural requirements for the operation of a trolleybus system can be equated with those of a suburban railway system.

By way of example the capital costs for catenary systems and electric power systems are quoted as follows:

Item	structural requirements	unit	appr. price in €	comments
1	two-track catenary system	km	210.000,-	catenary system
2	catenary crossing	unit	20.700,-	crossing trolleybus/trolleybus
3	electrical catenary switchgear	unit	55.000,-	junction trolleybus/trolleybus
4	mechanical catenary switchgear	unit	20.100,-	conjunction trolleybus/trolleybus
5	track separator	unit	14.800,-	mounting on tower
6	feeding point	unit	6.400,-	mounting on tower
7	catenary support	unit	3.500,-	including base
8	rectifier substation		430.000,-	for power supply, incl. building

The above mentioned prices are guide prices on the basis of the best bid, February 2004.

It is obvious from this that the operating authority must reckon with substantial expenses for a trolleybus system, ensuing from the complexity of the facilities. The infrastructural equipment is especially adapted to the respective local conditions (= the local road network), the relation between labour costs and costs of materials has to be calculated by 2/3 to 1/3. That means that 2/3 of the costs of erection have to be budgeted for the removal of a trolleybus system, without the possibility to supply the material for reclamation.

For a new acquisition of a solo-trolleybus at present € 400.000.- have to be budgeted, for an articulated trolleybus € 500.000,-. Because of the low number of pieces the price is about twice as high as the price of a comparable diesel bus. Depreciable life and service life are on average 15 respectively 20 years. As the trolleybus technology is closely connected to the existing infrastructure, trolleybuses are, like suburban railways, bound to their own system and thus the market for used trolleybuses is quite restricted

The complexity of a trolleybus system is reflected in an eventual tendering procedure analogous to diesel busses:

- The infrastructure of a trolleybus would have to be divided into:
  - (a) power supply, catenary system, electricity workshops assigned to the operating authority
  - (b) Vehicles and mechanical workshops to best profferer

This – simply theoretical – separation into operation and infrastructure brings about considerable economic and organizational disadvantages for the operating authority. The synergies of an integrated trolleybus operation analogous to those of suburban railway systems or underground systems are forfeited, endanger the continuing existence of trolleybus technology and do not result in any (financial) advantages for the operating authority. Another question to be considered as for suburban railway and underground systems, is where to draw the dividing line between operation and infrastructure, as the different technical parameters of the various local trolleybus systems (like voltage of catenary system, polarity, control of switchgears, regenerative braking etc.) cannot be interchanged at random.

The relationship between the systems of trolleybuses and suburban railways /undergrounds and the technical difference between trolleybus and diesel bus makes it obvious to classify trolleybuses analogous to suburban railway systems or undergrounds.

### **3. Environmental compatibility**

The trolleybus is among the most ecofriendly transport systems as regards exhaust emissions as well as noise pollution. The ecological advantages are further enhanced by the regenerative braking effect (braking energy is transformed into electrical power and fed back into the network), which means that up to 25% of the required traction power can be produced during operation.

According to statements of Dr. Hendlmeier (University of Munich) the following considerable environmental impacts can be avoided per 100 passenger kilometers (kilometers in relation to number of seats in the bus) by using a trolleybus instead of a conventional bus with diesel motor:

- 4,8 grams carbon monoxide (CO)
- 17,9 grams nitric oxides (Nox)
- 3,3 grams sulfur dioxide (SO<sub>2</sub>)
- 11,1 grams hydrocarbon (CH)

In addition a petrol consumption of 0,68 l diesel fuel per 100 passenger kilometers can be avoided.

On the assumption that a 5 km suburban bus route has on working days 12 operating hours with a bus frequency of 10 minutes and 3 operating hours with a frequency of 15 minutes, and on Sundays and holidays 15 operating hours with a frequency of 15 minutes, a pollution burden of 130 t per year can be avoided. In a medium-sized city like Salzburg, with an average trolleybus system, a conversion to diesel busses would result in an incredible increase of 5.600 t of carbon dioxide. It has also been taken into consideration that in many cases electric power required for the operation of trolleybuses has been recovered exclusively from renewable energy sources.

## 4. Legal and operational situation

Because of its technical and operational origin as „railless“ tram the trolleybus is treated like a railway in national legislation. In Austria this is laid down by the Eisenbahngesetz 1957, §5 art.3 as follows:

- (3) Electric trolley busses are regarded as tramways, unless it concerns liability for damages during operation of an electric trolleybus, even though in connection with fixed local railway system facilities.

The fact that the trolleybus basically resembles the suburban railways in operation and construction, has been taken into consideration in several countries of the EU and in Switzerland in a trolleybus regulation added as an amendment to the respective railway laws.

As regards operation the trolleybus system is run like a suburban railway system, irrespective of its legal classification:

- Clearly defined routes because of a fixed catenary system
- Fixed succession of busses depending on the existing power supply
- Special instruction and training of employees
- U-turns only in special places provided for turning, depending on the catenary system
- Possibility to influence right of way in traffic through catenary system
- Management of interferences and hazards with regard to active catenary systems (600 – 1000 Volt DC) in public areas

These basic conditions which are similar to those of suburban railways and undergrounds are also reflected in health and safety regulations for employees and in labour law (e.g. employees of an Austrian trolleybus company are automatically subject to the collective agreement for the Federal Railways).

## 5. Economic aspects

Economic aspects of the operation of trolleybuses are taken into consideration not only „per se“ but also in comparison to concrete alternatives. The trolleybus is competing mainly with the diesel bus, consequently the following economic aspects are presented in comparison with diesel busses:

### ■ **Benefits for the customers „Rails in the sky“**

The investment disadvantages of the trolleybus of about 10 to 20 per cent are compensated on the market by an improved income. Concrete scientific results showed, that the reception of the trolleybus on the market differs from that of the diesel bus. The catenary system gives the trolleybus and the public local transport system a constant visual presence in public areas. The apparent network of routes makes the accessibility by public transport systems more obvious and noticeable. The market presence of the trolleybus can be equalled to that of the suburban public railway – it has its „rails in the sky“.

### ■ **Accident statistics**

The choice between trolleybus and diesel bus is not a choice between two alternative vehicles but between alternative systems. This is further backed up by the fact that the accident statistics of the trolleybus correspond to those of the suburban railway and not to those of the diesel bus. The proportion of injured road users per passenger kilometer is 1:2 between trolleybus and diesel bus.

### ■ **External effects**

According to an investigation by Prognos/Basel concerning external costs of various transport systems, the trolleybus is ranking only about 7 per cent per kilometer above the diesel bus despite its costly infrastructure. That means that cost effectiveness is in balance between diesel bus and trolleybus.

In summary one can say that the advantages of the trolleybus as regards costs increase with the frequency of service on the routes.

## 6. Aspects regarding the EU-regulation concerning the allocation of public service contracts for passenger services

At present the trolleybus is not explicitly quoted in the draft for the regulation of the European Parliament and the council of Europe concerning measures of the member states in connection with demands on civil service and the allocation of public service contracts for passenger service by rail, road or inland navigation.

Expert legal opinions refer to the fact that due to national legislation the trolleybus must be classified as suburban railway. The legal recognition would on the one hand create legal certainty and on the other hand strengthen the position of the trolleybus with regard to environmental policy. An amendment of the following paragraphs or articles would be required:

- Article 4a (e): this paragraph refers especially to trolleybus operating authorities
- Article 6c: the term for trolleybus contracts must be equal to that of rail traffic and inland navigation – 15 years  
Note: this term corresponds to the average depreciable life of trolleybuses, which is about twice as high as that of diesel busses because of higher acquisition costs and a longer service life.  
This applies also to art. 6 c (i) and (ii) as the trolleybuses like railways, suburban railways and undergrounds require special vehicles - and there is no real market for that. As mentioned above the depreciable life of a trolleybus is twice as high as that of a diesel bus – on average in Europe 15 years.
- Article 7.2: Because of the connection between infrastructure, vehicles and employees in the operation of trolleybuses, the regulation in art. 7.2 should be extended to trolleybus operating authorities. No competition with diesel busses will arise because of the local restriction of trolleybuses and their largely differing characteristics. The regulations of art. 7.2 (a) and 7.2. (b) therefore fully apply to the trolleybus. The same applies to art. 7.3 – as in 100% of EU trolleybus operating authorities the competent authority has constructed and is operating the trolleybus system with public funds.
- Article 9.2: Because of the specific aspects of trolleybus operation this paragraph should include trolleybuses besides suburban railways and undergrounds.

## 7. Conclusion

Also in the European Union the trolleybus constitutes an alternative system to suburban railway and diesel bus. The trolleybus system is especially recommendable for medium-sized cities without trams. In narrow streets an (electronic) track guide can be installed. The trolleybus offers interesting future perspectives as regards alternative drive systems (fuel cell), as future-oriented drive concepts mainly turn to the trolleybus technology. With regard to the goals of the Kyoto Agreement the trolleybus is of great importance in the solution of this problem in centres of population with high exhaust gas pollution.

It will be decisive for the future development of this transport system whether it will be possible to take the specific requirements of a trolleybus system into account in European and national legislation and to grant it the status of a suburban railway.

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