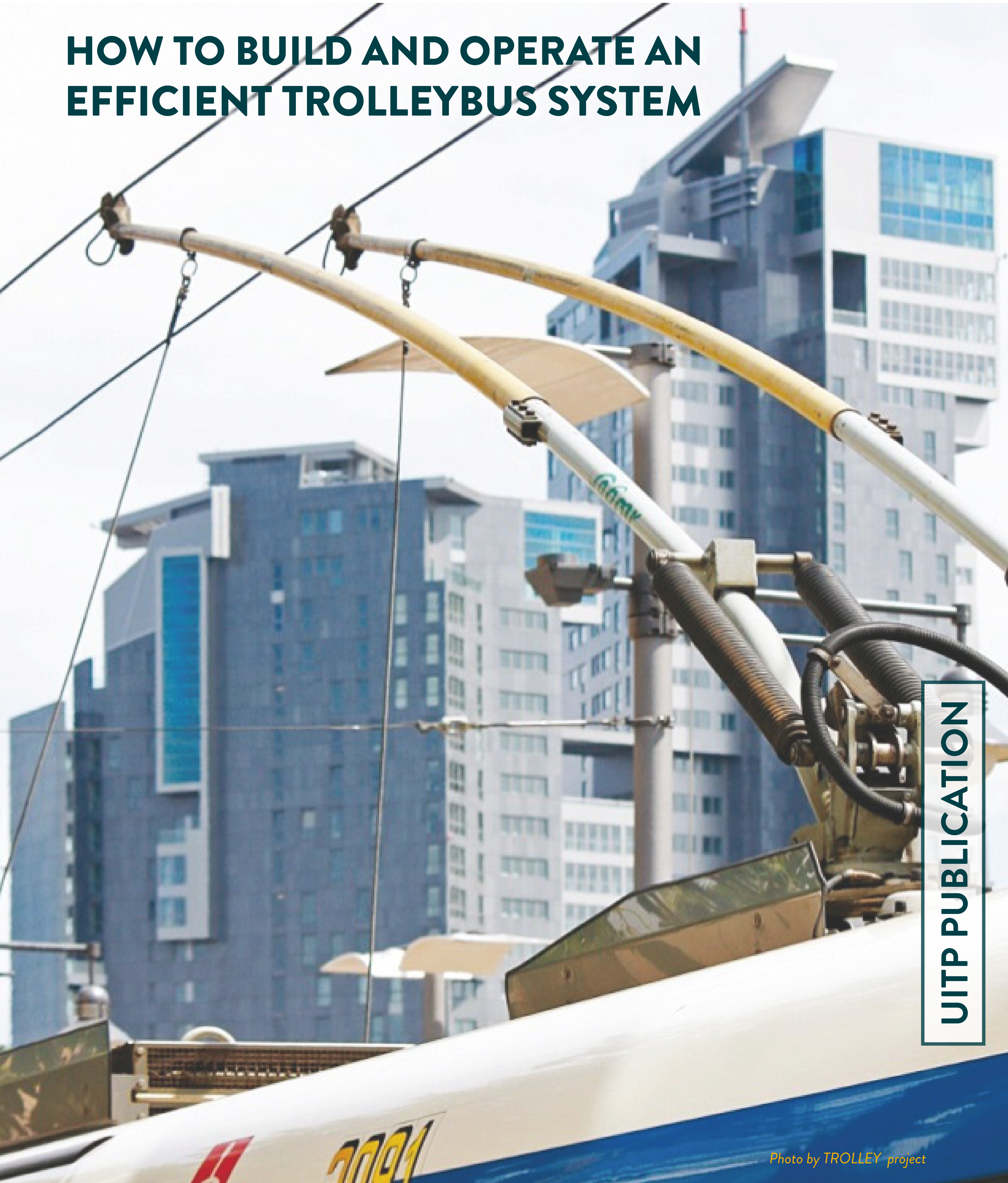
UITP ADVANCING PUBLIC TRANSPORT

HOW TO BUILD AND OPERATE AN EFFICIENT TROLLEYBUS SYSTEM



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HOW TO BUILD AND OPERATE AN EFFICIENT TROLLEYBUS SYSTEM

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FORWORD

Today, e-Bus technology is rapidly developing. Manufacturers of hybrid vehicles and electric buses claim that substantial energy savings can be made. Modern cities have ambitions to Invest in Clean Air, manufacturers offer in response to these ambitions, a wide range of product solutions to enter the market

The Trolleybus technology has a track record in UITP of more than 10 decades. In response to numerous requests, the Trolleybus Committee of UITP has established guidelines for the design and construction of new trolleybus systems. These form a practical handbook for those authorities considering the introduction of a trolleybus system, or the extension of an existing one.

Sharing of experiences: The guidelines have been formed by UITP members and debated and agreed on by the UITP Trolleybus Committee.
Let us hope that our initiative will have a huge impact and be used by a large number of city authorities and PTA's wishing to fulfill their objectives. To be successful, which it undoubtedly will be, the trolleybus will naturally be expected to continue to evolve further.
Finally, our sincere thanks go to all those who have taken part in the working group's editorial board. We hope these efforts will contribute to quality improvements within our business. These improvements will serve both our members and the public.

For the UITP,
Alain Flausch, Secretary General

Sergei Korolkov
Chairman, Trolleybus Committee
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CONTEXT

The trolleybus is a proven public transit system operated in over 310 cities worldwide (56 countries); there are more than 40 000 trolleybuses in operation in the world. Far from being a «has been» mode of public transportation, 45 trolleybus systems have emerged worldwide since 1990, 27 of which are in Europe. Currently, cities such as Leeds (United Kingdom), Riyadh (Saudi Arabia), Malatya (Turkey), Verona (Italy) and Montreal (Canada) are either introducing a trolleybus system or are studying the feasibility of its implementation. The trolleybus is the most reliable and most common electric on-road urban public transit vehicle in the world. Furthermore, it is a readily available solution to help cities achieve environmental objectives such as the European community's emission reduction target of 60 % by 2050, as laid down in the European Transport White Paper. Results of a study in Osnabrück (Germany) show that the implementation of a trolleybus system is the fastest way to reduce CO2 emissions in the city – better than the implementation of a tram system or the use of the most recent diesel bus technology (euro 6).

This pamphlet will be of interest to those who wish to familiarise themselves with trolleybus networks and the requirements to build and operate such a network. Subjects addressed are: «The trolleybus: the most efficient electric heavy duty public transit vehicle available today», «the vehicles», «the electrical network», « capital and operational budget planning», «a cost calculation model» , «the business case», «the pre-tender» and «marketing and communications issues and challenges».

Figure 1: New trolleybuses for Riyadh, Saudi Arabia (photo by Vossloh Kiepe GmbH)

THE TROLLEYBUS: THE MOST EFFICIENT ELECTRIC HEAVY DUTY PUBLIC TRANSIT VEHICLE AVAILABLE TODAY

The trolleybus is the only electric heavy-duty public transit vehicle - available in versions of 12 meters, 18 meters and 24 meters - which can not only equal the operational performances of diesel-propelled buses, but also exceed them. For example, while a diesel bus can remain in customer service for periods of approximately 24 hours before it must return to the depot for refuelling, a trolleybus can remain in customer operations indefinitely. As for diesel buses that remain in customer service for extended periods of time, trolleybus operations can be planned to allow driver rotation on customer routes, hence minimising non-productive travel back to the depot. The electric battery buses commercially available today have not yet attained, for major bus routes with heavy ridership, a level of operational efficiency and economic performance akin to those of today's diesel buses.

The trolleybus is a dynamically charged électrobus (electric bus). The dynamic charge is provided through direct contact between the trolleybus' poles and the overhead contact line; direct contact is the most efficient method to transfer electrical energy from one electrical circuit to another. It can remain in customer service as long as operationally required and can travel autonomously over short distances up to approximately 10 kilometres, without contact with the overhead contact line; relying solely on the electrical energy stored in on-board batteries. As the capacity and performance of on-board energy charging, storage, and management systems improve, and as the energy requirement of sub-systems decreases through improvements resulting from R&D efforts; the off overhead contact line autonomy of the trolleybuses will increase.

The major challenge of battery bus designers is to determine the most efficient ratio of bus autonomy to battery pack weight. In other words, the autonomy of a bus is directly proportional to the energy storage capacity of the on-board energy storage unit. The interaction between size, weight, thermal behaviour, life cycle and capacity has to be optimised. Ultimately, given that the vehicle must not exceed a maximum axle load, the importance of the weight of the battery pack must be weighed against the number of passengers the vehicle is intended to carry.

Figure 2: Hybrid electric bus from Eberswalde, Germany (photo by Barnim Bus Company mbH)

Today's trolleybuses can be regarded as «hybrid electric buses», hence a cross between a traditional trolleybus and a battery bus. The hybrid electric bus (today's trolleybus) can charge its energy storage units under the overhead contact line of a trolleybus during the journey and thus drive, both on line sections with an overhead contact line, and on line sections without an overhead contact line. In this way, the disadvantages of the trolleybus (i.e. overhead contact line needed) and of the battery bus (i.e. low range) can be overcome by the hybrid electric bus.

Hence, the implementation of an electric urban bus system with overhead contact lines over only about 30 to 50 % of the line becomes possible. It is thus possible to avoid line sections with overhead contact lines in:

- Sensitive urban areas where the overhead contact line itself, but also its suspension poles or outside walls, is regarded as extremely obstructive;
- Areas in which very complicated and cost-intensive crossings and switches would be needed for the overhead contact line;
- Areas with less intensive cycles due to a lower demand. In other words, in areas where an overhead contact line system would not amortize itself within a foreseeable future;
- Areas where an overhead contact line system would have to be cut off in case of an emergency because space is restricted;
- Areas only needed for turning or in case of service disruptions.
- Areas where the overhead contact line conflicts with heavy loads transport routes.

The development of off-line electric buses is closely linked to the R&D efforts to develop less energy consuming on-board auxiliary systems such as AC and heating systems.

THE VEHICLES

Although it was introduced more than a century[1] ago and after the automobile, the Trolleybus is thought of by some as the more outdated mode of transportation. Like the automobile, modern trolleybuses are nothing like their ancestors; they are high tech electric vehicles equipped with the latest technologies, that can be operated on or off the grid, independently of overhead wires by means of dual power (electrical or diesel auxiliary power unit). Driving comfort is better than that of internal combustion engine vehicles; the electric drive motor generates far less vibration and noise than internal combustion engines and their inherent transmission. The passenger compartment is more spacious and ergonomically better designed; the propulsion system of the trolleybus is much smaller, hence the additional available space is used for passenger comfort. The use of state of the art electronic control systems enables optimisation of energy consumption. What is more, the "at wheel" higher energy efficiency of the electric motor (40-45 %) against any mechanical transmission of internal combustion engines (25 %) makes the trolleybus the most efficient and most environmentally friendly high capacity road vehicle.

Trolleybuses are available as standard 12 metre trolleybuses, 18 metre articulated trolleybuses or 24-25 metre double articulated trolleybuses.

1 The first buggy powered by an electric motor connected directly to the electric power grid via a pole was introduced by Herr Werner von Siemens near Berlin (Germany) in 1884. By the early 1900, the concept had evolved to what was called the rail less tramway. In the early 1920, it was referred to as the Electric Trolley Omnibus.

Figure 3: 25-meter-long double-articulated trolleybus (photo by Hess AG)

Several futuristic trolleybus designs have been produced in recent years. These aim at giving trolleybuses a distinct signature so that they are easily distinguished from diesel or gas powered buses. The first such design was the Cristalis in Lyon, prior to 2005, while in 2012, streamlined trolleybus models the «MetroStyle» by Solaris/Cegelec and the «ExquiCity» by VanHool/Kiepe were introduced in Salzburg and Parma/Geneva. These latter trolleybuses have an appearance closely resembling that of modern trams. The new Hess Swisstrolley4 deliveries to Limoges in 2013 are also of a revised, more streamlined design. These trolleybuses are often operated as Bus Rapid transit vehicles. For example, in Zurich, Switzerland, line # 31, is a high-capacity trolleybus line using double articulated low floor modern vehicles (25 m vehicle) carrying more passengers than some of Zurich's tramlines. It is a radial line which serves four S-Bahn stations, as well as the main train station. It is operated on central dedicated lanes; it makes use of various traffic signal priority systems at all intersections and, dynamic and static in-vehicle information is made available throughout the route. The city centre of Zürich is fully operated by electric public transportation vehicles (trolleybuses and trams).

The trolleybus does not produce emissions while running as it consumes only electricity. If, in addition, the electricity used is produced using renewable energy, the trolleybus system is a true «zero-emission» public transport system. The trolleybus systems in Salzburg and Landskrona are, for example, true «zero emission» systems as the source of their electricity is «hydro».

The electric power system of a trolleybus is comprised of four major sub-systems: the Propulsion system, the Energy management system, the Pole system and the Auxiliary power system.

PROPULSION SYSTEM:

A trolleybus has the same driving characteristics as a diesel bus. However, it can be equipped with several electric motors, usually mounted under the floor rather than at the rear of the bus like diesel buses. Because of the inherent high torque capacity of the electric motor, a gear box, unlike the diesel bus, is not required. Moreover, significant space can be gained if electric wheel hub motors are used instead of conventional electric motors, allowing for the design of a more spacious and comfortable trolleybus interior design.

ENERGY MANAGEMENT SYSTEMS:

Energy management systems: A trolleybus is operated electrically which is the most efficient way to get power to an engine. As long as a trolleybus is operated under the overhead contact line, its range is more or less “infinite” as its fuel source - electricity from the overhead contact line - is continuous.

POLES SYSTEMS:

Typically, trolleybuses are equipped with two trolley poles, which are fitted in parallel on the top of the trolleybus, at the rear. They draw the traction current from the two wires of the overhead contact line one pole per wire. One wire, referred to as the negative wire, is usually the 0V-potential wire and is usually installed on the outside, while the other wire, referred to as the positive wire is the 600 V or 750 V wire and is installed on the inside. Pole systems for automatically uplifting and connecting to the contact wires, even if the overhead contact line is not situated right above the vehicle, are in development.There are exceptions such as in Geneva in Switzerland where the 0V-wire is the positive contact wire and installed on the outside. The 600V–wire is the negative one and installed on the inside


Figure 4: Trolleybus poles (photo by TROLLEY project)

AUXILIARY POWER UNIT:

Modern trolleybuses are usually equipped with an onboard auxiliary power unit that takes over as the energy source when the trolleybus must disconnect from the overhead contact line. There are two major types of auxiliary power units: the diesel auxiliary power unit and the electric auxiliary power unit. One of the characteristics of a trolleybus equipped with an auxiliary power unit is its ability to temporarily disconnect from the overhead contact line and continue its journey in standalone mode. The Termini line in Rome (Italy) is operated over 3.4 kilometres without contact with the overhead contact line. Over that distance, it is the battery auxiliary power unit that provides the required energy. The electric auxiliary power unit does not generate energy; it stores the required energy in energy stockage units such as batteries or/and ultracapacitors. Batteries can be charged dynamically through energy recuperation during deceleration, through the poles during regular overhead contact line operation or through plug-in to the electrical grid when parked.

THE ELECTRICAL INFRASTRUCTURE

Today's trolleybuses are dependent on a suitable infrastructure in the form of an Overhead Contact Line system and power supply installations (substations, cabling). Clean electric power is flexible and can be produced in a number of different ways such as hydro, atomic, wind, sun, etc.

While the overhead contact line is essential to feed electricity to trolleybuses, it is also a clear indication to the Public Transport customer that a public transport route is active and will remain active for many years – this assurance of a public transport service will encourage ridership and urban development and revitalisation. In Salzburg (Austria), public transport customers use the slogan "the tracks in the air", as it indicates to them that there is a regular public transport service where they see the overhead contact line.

Figure 5: Trolleybus in Salzburg guided by "the tracks in the air" (photo by TROLLEY project)

To plan and build an efficient trolleybus electrical infrastructure, it is important to understand the environment in which the trolleybus network will operate. The various factors that must be identified are:

REGARDING **TROLLEYBUSES:**

- The number of trolleybuses required for customer service at peak periods;
- The timeline and routing of the lines; and the traffic environment of the other vehicles sharing the same routes;
- The type and performance characteristics of the trolleybuses' on-board electrical energy charging, storage and management systems;
- The performance characteristics of the powertrain;
- The performance characteristics of the auxiliary systems;

REGARDING THE **ELECTRICAL POWER NETWORK**:

- Identification of the different routes to be connected;
- Identification of the various operational, technical and urban factors that may influence the location of switches and crossings;
- A preliminary assessment of the required electrical energy supply system;
- The architecture of the overhead contact line network. For today's urban planners, it is essential that the overhead contact lines blend in naturally with the urban landscape;

REGARDING **SOCIO-POLITICAL POLICIES**:

- The introduction of a trolleybus system can be a very powerful tool for sustainable and urban development. It is a structured network around which existing communities can be revitalised and new communities developed.

The overhead contact line network is an extremely flexible system, which consists of a number of different parts. At first the overhead line has to be held in position. For that, there are two main possibilities: wall anchors and poles.

WALL ANCHORS: the use of anchors on the walls of buildings is the least expensive solution; of course, the walls must be strong enough to sustain the force.

POLES: the use of poles is a universal solution when the use of wall anchors is not feasible; however, it requires civil engineering work for its implementation. Several requirements can be mutualised on a single pole such as street lighting, urban technical units and overhead contact lines. Furthermore, poles can be designed to blend into the local architecture and landscape.

It is possible to leave, enter or cross an overhead contact line. Electrical switches will separate two lines; mechanical switches will link two lines, while crossings will enable a trolleybus to cross two lines at different angles. It is also possible to cross a tramline's overhead contact line if necessary, without power loss for the trolleybus, at angles with less than 600. To reduce costs, plan your system with as few crossings and switches as possible. Note that it is also possible to design the system so that the trolleybus infrastructure crosses a tramline overhead contact line if necessary.

There are two main overhead contact line system designs for switches and crossings, the «pipe» and the «tense» systems. Both systems have a common feature - they have two contact wires. These wires are connected to a direct current energy supply network; one wire is the positive line, while the other is the negative line. Overhead contact line wires are available in different sizes, expressed as «square root» values. The most common sizes for trolleybus overhead contact line wires are expressed as square root 80, 100, 107 and 120, the square root 80 wire being the smallest (and lightest) and the square root 120 wire being the largest (and heaviest). The simplest construction is the straight contact wire which connects the start and the end of a line. If there is no need to connect another line it is not necessary to implement crossings and switches.

Figure 6.1: Trolleybus infrastructure (photos by Per Gunnar Andersson)

Figure 6.2: Trolleybus infrastructure (photos by Per Gunnar Andersson)

Figure 7.1: The pipe system (photos by Andreas Randacher)

Figure 7.2: The tense system (photos by Andreas Randacher)

The **PIPE SYSTEM** also called tube system, is designed so that switches and crossings are suspended under the two continuous uninterrupted contact wires (positive and negative) and are interconnected by copper tubes. This system is simple to implement and is very simple to repair in case of a failure (e.g. derailing) as only the pipe gets damaged; the contact wire stays in place. Furthermore, in the event of changing operational requirements and/or changes in the assignment of public transport routes, it is easy to move switches and crossings.

Figure 8: The Cloud Glitter (photo by Electric Tbus Group)

The **TENSE SYSTEM** implies that the overhead contact line wires are connected directly to electrical switches. The switches are under mechanical tension so when a contact wire breaks, the whole switch / crossing loses tension on each side. In such a situation, the whole crossing system becomes non-functional. It is also not possible to move the crossing because it will be held in position through the connected contact wires.

A power supply (power sub-station) is required; it will supply a high voltage alternating current that is rectified into direct current. The overhead contact line is separated into different segments, each getting its electrical power from switchgears. As a key element of the sub-station, the transformer must be dimensioned carefully; if it is too small, the overhead contact line will lack power, while if it is too big, it will be extremely expensive to acquire and will generate significant no-load losses. The number of required substations is established as a function of the expected load on the overhead contact line. The dimension and performance of the power sub-stations and the level of redundancy acceptable to trolleybus operations is also a function of the electrical losses of the overhead contact line. Normal distance between substations is 2-3 kilometres.

CAPITAL AND OPERATIONAL BUDGET PLANNING

Many cities would like to make their public transportation both noise and emission free and therefore switch to the operation of electric vehicles. Regardless of the type of project one wishes to sponsor or undertake, the bottom line will always rest with these key questions: how much will it cost to build? And how much will it cost to operate year after year? The actual cost of the individual project is usually difficult to estimate. While the prices for electric buses, trolley lines and maintenance facilities are generally known and planning work can be calculated; the difficulties are mainly found in the social, economic and regulatory environments, and in accounting practices, as they vary from one country to another. However, we can provide a list of «elements» which must be considered to build a capital expenditure budget and an operating budget. Each of the elements can be weighed as a function of local specifics. Accordingly, trolleybus implementation costs can be as low as €1M or as high as €20M per kilometre.

The budgeted total investment costs should include the acquisition and construction costs, an appraisal contingency, a risk contingency, a project contingency, cost of inflation throughout the building period, taxes and financial costs.

The budgeted recurring operational costs should include the cost of customer service delivery, the cost of vehicle and infrastructure maintenance and an appraisal contingency. Of course, if the trolleybus network is to replace an existing public transit line or network, the recurring operational costs become differential costs.

Figure 9: New trolleybus for Parma (photo by trolley:motion)

Typically investment costs include:

•The cost of preparatory studies;

•The cost to adapt or construct the bus depot: electrical infrastructure within the trolleybus depot, general adaptation of the depot, a workshop for the team responsible for the maintenance of the electrical network, including space for the required vehicles, replacement parts, tools and office space, professional services for studies and construction;

•The cost to adapt the bus operations centre: the transmission network for the centralised energy management centre, power sub-stations control equipment, the energy control station equipment and professional services;

•The cost to acquire the trolleybuses and specialised overhead contact line maintenance vehicles can include costs for: the actual vehicle acquisition, the required spare parts, special tooling as well as equipment and professional services;

•The electric power network construction costs: the acquisition of land for the construction of power sub-stations, the acquisition of equipment and material, construction work and associated professional services;

•The cost to adapt the urban infrastructure and urban technical network: dismantling urban infrastructure, digging up and relaying cables and other equipment, the construction of the new network and the implementation of mitigation measures, including professional costs, and finally;

•The cost of operational integration: personnel training (drivers, operations control, trolleybus maintenance, electrical infrastructure maintenance, human resources...), engineering and technical support, trolleybus maintenance support, supply chain support, customer service delivery support, electrical network maintenance support, urban infrastructure maintenance support, etc.

Typical recurring operational costs include:

•Service delivery: administrative support personnel, drivers and operations managers, electrical energy and diesel savings (when applicable);

•Maintenance: bus operations centre equipment, electrical power network equipment and infrastructure, trolleybus maintenance, trolleybus depot maintenance, spare parts and consumables, tree maintenance along the overhead contact lines, etc.

A COST CALCULATION MODEL

An experienced German transport planner developed a calculation model, using an innovative formula, to calculate the potential cost of a planned trolleybus project. Such valuable insight into the cost of a planned project enables an operator to accurately plan capital expenditures as well as borrowing requirements. This financial data additionally provides the necessary insight for establishing the right kind of ticket prices for passengers on the network.

This model was applied with success, to appraise the infrastructure costs of the urban trolleybus system for the City of Esslingen (Germany). Esslingen has a population of 90 000 inhabitants, a population density of 2000 inhabitants per square kilometre, a purchasing power of €48 000 per resident and an unemployment rate of 3 %. Urban public transport planning studies indicated that an ideal trolleybus network size for Esslingen would be 20.5 kilometres. Results obtained using the model indicated that the cost to build the trolleybus system would be €23.9M, €16M of which would be for the network and infrastructure costs. Hence, city planners anticipated that the price of network and infrastructures, per kilometre, to be approximately €800 000.

The model applies to small rural networks as well as large public transportation systems in major urban areas. The use of the model requires the use of local public transportation parameters and demographic data such as the regional population size, population density, unemployment statistics, age structure and purchasing power, etc.

The “Esslingen example” describes general cost structures based on pre-defined parameters. The model assumes that the required power sources and urban electric grid for a new trolleybus network are already in place. If not, any new system will obviously increase the project cost. Often other factors also influence final construction and development costs such as the desired use of dedicated bus lanes. Moreover, local specificities must be considered such as varying topography, the degree of infrastructure development and the type of soil upon which infrastructures must be built. All of these aspects must therefore be considered when drawing up final calculations and drafting realistic project budgets.

THE BUSINESS CASE

There are probably as many reasons to explore the feasibility of building a trolleybus network as there are cities. A number of factors will likely contribute; such as the desire to reduce the environmental footprint of the urban bus fleet, political platforms that include sustainable development objectives, and the will to decrease the trade deficit caused by massive foreign fossil fuel imports.

Undoubtedly the idea of implementing a trolleybus system will raise questions and be challenged with objections. These will need to be documented and addressed appropriately. Also from the onset, significant funding will be required, notwithstanding that the long-term benefits could outweigh the capital expenditures required to implement the trolleybus network. The process to obtain the required funding may vary from one city to another, and it is likely that a full business case study be required. The business case should include the results of a feasibility study which itself should include an appraisal of social, economical and environmental impacts, and an analysis of capital expenditures and life cycle costs. Its preparation is likely to be time consuming and demanding on local expertise. It must be rigorously prepared and planned; and while certain activities can be carried out simultaneously, the business case should be prepared sequentially and include one or more validation of milestones.

Cities such as Leeds (England) and Montreal (Canada) which were recently successful in preparing such studies used a similar approach. They identified a ‘Champion’ amongst their senior staff to lead the initiative and see it through to completion. They also built a multidisciplinary project study team and obtained the required financial resources to carry out the feasibility study and submitted the business case report to public authorities for approval.
In essence, to enable authorities to select the most optimal trolleybus option, their feasibility studies

presented various trolleybus network scenarios. Results of implementation and integration analysis for each scenario were presented; this included drafted implementation principles such as the identification of recommended electrical power network configurations, urban hardware (i.e. mast types), trolleybus types and on-board energy management and storage systems. In addition, a class D financial analysis (± 30 %) was prepared for each scenario. This analysis included an assessment of the capital investment costs to design, build and commission the electrical power network, the trolleybus depot and the trolleybus control centre. It also included an assessment of the capital investment costs for the acquisition of the trolleybuses and required maintenance systems, tools equipment and vehicles, and an assessment of potential savings and expenses on recurring operational budgets. Once authorities selected the optimal scenario, the financial analysis of that scenario was refined to a class C (± 20 %) and a detailed description of the physical, operational and financial characteristics of that scenario was prepared.

Figure 10: Photomontage of planned trolleybus scheme for Leeds, UK (photo by Leeds New Generation Transport (NGT))

DETAILED DEVELOPMENT UP TO THE PRE-TENDER

Once a trolleybus network scenario / scheme has been selected, it is essential to set out a dedicated Procurement Process. It is recommended to prepare a clearly defined Procurement Brief and establish the Procurement Process. The procurement process itself is exhaustive and, to ensure that it is deployed and carried out efficiently, it will be necessary to develop an Organisational Structure (team/resources and allocated budget) specific to the trolleybus project.

To proceed to the tender phase, the trolleybus network scenario / scheme must have been defined and thoroughly documented, that is to say that all technical, engineering, social, economical, political, environmental and sustainability considerations have been documented, assessed and factored into the design of the scheme. Also, network expansion opportunities have been identified and assessed and, if pertinent, have been factored into the design of the network. Usually, the budget requirement to build the trolleybus network scenario / scheme, once all these factors have been factored in, has been appraised to (± 20 %) include a risk allocation.

The following is a non-exhaustive list of key elements of an effective procurement process that should be addressed:

•Identify the Project / Procurement Governance and responsibilities and define the overall Governance processes;

•Define the procurement management programme, procurement stages and inherent procedures;

•Define primary and secondary procurement and commercial objectives;

•Define the market engagement & consultation programme and strategy;

•Define the benefits realisation strategy and delivery plan;

•Prepare and implement a procurement process evaluation strategy.

Figure 11: Trolleybus scenario (design by Electric Tbus Group)

Before engaging in the bid process, it is essential to know what the market can offer; to identify potential bidders and prepare high-level cost appraisals for all the bids that will be tendered. A cost benchmarking with other trolleybus operators is important, as different solutions and manufacturers will have different costs. Given the high concentration of trolleybus systems and their rich history of trolleybus operations, Eastern European Union countries can provide valuable information and data. This has led to the establishment of several trolleybus and electrical system manufacturers and a healthier competition.

MARKETING AND COMMUNICATIONS ISSUES AND CHALLENGES

The promotion and marketing activities of a trolleybus scheme are as important as the technical, engineering and operational planning activities. Recent experiences, notably in Landskrona (Sweden), Leeds (United Kingdom) and Montreal (Canada) indicate that a proactive communications and stakeholder engagement is a must.

Communications with **internal stakeholders** must be proactive and structured. This is often overlooked but is vital to avoid the spread of inaccurate information. Indeed, internal stakeholders require a common understanding of the project to work towards the delivery of a shared goal in a structured way. Hence, regular and accurate updates on progress should be provided to internal staff. Briefings are particularly important ahead of major public announcements.

External stakeholders who don't have enough information about the project are not able to make informed choices about whether they support the project or not. Engaging with external stakeholders includes providing information, consulting on detailed issues, involving local communities in the development process and empowering them to make informed choices. It is important to try to communicate with 'hard to reach' groups (e.g. the elderly). External messages must be factually correct and consistent.

A lack of public information about the project can lead to the creation of **urban legends**. These may be created by opponents to the scheme to influence public opinion. When this occurs, there must be a quick response as it is difficult to correct inaccurate information once in the public arena. Social media can be a useful tool for responding to urban legends.

A planned, targeted, effective and consistent programme of communications will be required in terms of **mobilising the population in favour of trolleybuses, the only state-of-the-art proven electric bus available** for full scale operation. A Communications Management Strategy must be developed to set out how the Project Team will establish, develop and maintain active support for the project. There are a number of key groups who have scope to influence the success of the project. These groups must be identified at the outset. Key influencers include: politicians, business leaders, transport organisations, the general public, interest groups and the media.

Figure 12: Trolleybus image campaign "ebus – the smart way!" (design by TROLLEY project)

The following **KEY STEPS** are fundamental in ensuring effective communications:

STEP 1: Identify the aims and objectives;
STEP 2: Identify the Communications Principles;
STEP 3: Identify the stakeholders;
STEP 4: Undertake stakeholder analysis;
STEP 5: Develop an action plan for each stakeholder;
STEP 6: Develop an overarching communications action plan
STEP 7: Record, Monitor and Report.

A range of tools and techniques can be used to communicate and consult with stakeholders. Different tools will be appropriate for different groups. However, common tools include: meetings, presentations, workshops, focus groups, exhibitions, drop-in sessions, direct mail, questionnaires and surveys.

CONCLUSION

The transition of trolleybuses to autonomous electric buses, when technology will allow, should be straight forward; it will replace the trolleybuses' electric energy management and storage systems with state of the art systems and will remove the overhead contact wires; adapting trolleybus power substations to feed quick charge stations that will be installed along the bus route corridor.

Until recently, the major drawback of a trolleybus system was that it could not be implemented in areas where it was not possible to install an aerial contact line for either urban or physical reasons. Fortunately, today's technologies enable trolleybuses to be operated over significant distances greater than 10 kilometres while disconnected from the grid. The trolleybus is, therefore, today's public transit electric mobility solution. It is adapted to the future, as the only state-of-the-art, heavy-duty, electric bus available today.

For those who wish to act immediately and reduce their ecological footprint, while responsively preparing for tomorrow's technological public transit solutions, the implementation of a trolleybus network provides several advantages; amongst them, the reduction of the environmental footprint of a fossil fuelled bus fleet – to '0' emissions; energy efficiency, in that electric motorisation systems are more efficient than fossil fuel systems; and energy flexibility, in that electricity can be produced in many ways.

Figure 13: Trolleybus in Brno – winning photo of TROLLEY's European photo competition 2012 (design by TROLLEY project)

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ABOUT THE CURRENT PUBLICATION

In response to numerous requests, the Trolleybus Committee of UITP has compiled guidelines for the design and construction of new trolleybus systems. These guidelines form a practical handbook for those authorities considering the introduction of a trolleybus system, or the extension of an existing one. This publication provides information about the issues involved in opening an intermediate electric capacity system. It also describes the methods of financing, owning, leasing and contracting for construction, management and operations. UITP members contributed to compiling the guidelines. This information was then debated and agreed upon by the UITP Trolleybus Committee.

ANNOUNCEMENT

UITP TO PUBLISH NEXT LEVEL IN-DEPTH GUIDELINES FOR THE DESIGN AND CONSTRUCTION OF NEW TROLLEYBUS TRANSPORT SYSTEMS

UITP is proud to announce its detailed guidelines for selecting and planning a trolleybus system. These guidelines will be compiled by UITP in response to requests from transport authorities. They will be released progressively.

Guidelines for Selecting and Planning a New Trolleybus System. To be published periodically.
Format: CD and UITP Web Portal (Knowledge Storehouse Mobi+ and MyUITP)
Language: EN

The range of material will be published in separate but linked parts. Each publication will meet the degree of detail required by the reader. Level 1 summarises the (high level) key issues, procedures and decisions from the initial definition of a city's transit objectives to the eventual opening of a new system. Level 2 explores, in greater detail, 8 related wide-ranging topics outlined in Level 1.

The next publication "Planning Guidelines" will feature 8 chapters:

1.Introduction

2.Worldwide overview

3.Trolleybus system infrastructure

4.Preparing a business case

5.Procurement activities

6.Communication and marketing

7.Cost appraisal

8.Comparison of various powertrain techno

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