Introduction

Cities are not just concentrations of people, they are also centres of economic activity and decision-making. Many European cities now face a transportation crisis. The popularity of the car has caused widespread congestion and for many, serious atmospheric pollution poses a serious threat to health.

This case study outlines the way in which Adtranz has created the tram of the future, the EUROTRAM, for Strasbourg - the European city lying at the hub of the European Union. The EUROTRAM will be at the centre of the Strasbourg transport policy into the next millennium. Adtranz is a major force in the railway industry, with a new name and a new identity. The Group was legally formed in January 1996, as a result of a 50/50 merger of the transportation activities of the electrical engineering group ABB Ltd, Zurich, Switzerland and Daimler-Benz AG, Stuttgart, Germany.

The Adtranz group is an international railway company with strong local presence. It is the world's most complete provider of railway systems for local, urban, regional and interurban passenger and freight transport. The Group employs over 22,000 people world-wide. Adtranz UK & Ireland employs around 4,500 people at 14 sites. Strasbourg is one of the most prestigious European cities and has recently grown in eminence because it houses the European Parliament. It is a vibrant and growing city and a pivotal communications centre with the rest of the European Union. It is not surprising, therefore, that Strasbourg has opted for one of the most advanced internal transport systems in the world today - the EUROTRAM.

If you were asked to design a new tram system for a modern European city, what would be your prime considerations? Features might include - style and sophistication, reliability and accessibility, ease of entry and exit to trams, good value for money and, of course, harmony with the environment. This case study focuses on how Adtranz developed a product that would meet Strasbourg's needs.

Strasbourg and trams

In the late nineteenth and early twentieth century, the tram was an elegant feature in many European towns and cities. At a time when there was little traffic on the roads, trams provided a stylish and pleasant form of municipal transport. The tram reigned supreme for much of the first half of this century, before going into rapid decline in the 1950s and 60s. It was during this period that Strasbourg replaced its tram system with engine powered motor buses. Motor buses seemed to represent more flexibility in an era in which urban centres were increasingly becoming congested with traffic.

Today however, many town planners have come to realise that trams actually provide for the future rather than the past. Increasingly, we are seeing a growing interest in the development of tramways and light metro systems. The 21st century is likely to be 'the age of the tram.' We can see the increasing interest in trams by studying the chart which identifies a variety of new tramway projects, particularly in the United Kingdom.

Environmental considerations

Today, environmental concerns are at the forefront of any new development. Modern forms of transport, such as the motor car driven by petrocarbons, have tremendous potential to create unacceptable levels of pollution. However, we can change by planning in favour of sustainable 'green' city environments. Strasbourg, in choosing the EUROTRAM, has gone for the 'green' solution.

Strasbourg was one of the first European cities to recognise the

dangers of pollution resulting from car and lorry exhaust emissions. By 1962, the public network system in Strasbourg was based entirely on diesel buses which were very noisy and gave off unpleasant fumes. In 1972, la Communaute Urbaine de Strasbourg (CUS - the local government authority in Strasbourg) officially recognised the dangers of pollution that were leading to the asphyxiation of the city centre. Official studies were carried out to find out the best ways of relieving the city centre from traffic congestion and pollution. Initially, a new reserved-track tramway system was considered as a solution to these transport problems. However, this project was shelved in the 1980s in favour of a new ambitious project for a metro system (similiar to the London Underground).

While this project was favoured in some quarters, it would have been very expensive to put in place and would have caused enormous disruption. The tramway idea began to find favour again and its supporters pointed to the impressive return of tramways in Nantes in 1985 and Grenoble in 1987. The case for trams was gaining momentum! However, it was not until 1990 that the CUS in Strasbourg provided detailed approval for a new tram system. On 17 June 1991, the then French Prime Minister, Edith Cresson, confirmed the scheme's Declaration of Public Interest, allowing civil engineering work to begin and contracts for the track work and rolling stock to be placed. In effect, this gave the go ahead to the project.

Public transport

As well as improving public transport, the light rail system is intended to act as the catalyst for change to the entire city centre. The associated pedestrianisation work, together with better transport links, are expected to reduce the use of private cars. The use of electric traction on the LRVs (Light Railway Vehicles) will also remove noise and pollution from the city centre. In essence, Strasbourg was keen to create an integrated transport system linking together the various ingredients of a modern transport system - i.e. a modern rail and road system to bring passengers into and out of the city, combined with a modern tram system to move people around the city and an extensive pedestrian system in the city centre. The name of the game was integration.

The arguments put forward for the tram system were:

- it provided the opportunity to restructure the urban environment and would make the city a more pleasant place to live
- its introduction would reduce the use of private cars in the city centre and raise public transport patronage
- the operation of quiet, electrically powered vehicles in the city centre, especially pedestrianised areas, would significantly reduce pollution levels.

The route chosen for the first line was to be a 12.65km double-track tramway with 24 stops, entirely on reserved track or in pedestrianised areas. The track would link important suburbs of the city, the hospital area, key communities and the city centre. Trees were planted along the route and the track area was turfed to make it attractive. Civic leaders recognise that any city needs a reliable and accessible public transport system. Strasbourg needed a form of transport that would enhance its status 'at the heart of Europe.' With its advanced, proven, water-cooled a.c. traction equipment, the EUROTRAM is quiet, clean and pollution free.

Its modular construction requires the minimum swept path for its tracks and permits the addition of extra modules to accommodate future growth in ridership. The civic leaders recognised the need for a system which was more than just purely functional but a work of art as well. They turned to the experienced industrial architect Phillippe Neerman's design agency IDPO (whose work includes the tramways of Brussels, Nantes, the Hague, Amsterdam and Grenoble) and engineering consultants Mertram to develop the concept design for the new vehicle.

In effect, they had to create a vision of Europe in the 21st century, something for the citizen of Strasbourg to be proud of - something which has become the focus of the city's identity, its community spirit and its self-confidence. Work is in hand to extend the system, with an additional line to be completed in 1999.

The vehicles

The light rail vehicle was carefully developed to appeal to the passenger. Since there are limits to the acceleration and deceleration forces a passenger will tolerate, journey times on an urban transit system are principally affected by the duration of stops.

The EUROTRAM has a low floor over 100% of its length, no obstructions below seats in the saloons and no steps to negotiate. Facilities for the mobility impaired are superior to those found in previous vehicles. Powered wheelchair ramps are fitted to the centre passenger saloon to assist disabled passengers. These ramps are controlled by the driver from the cab with closed-circuit television allowing the driver to monitor all passengers entering and alighting from the vehicle.

The body structure is comprised of welded wide aluminium extrusions, stiffness being provided by a deep keel in the centre of the roof. This method of construction gives a body shell which is both light and strong. The large windows are bonded to the structure in a manner similar to many car windscreens, so giving a light and pleasant interior. The seats are of the tip-up 'cinema'' type. They are cantilevered from the body-side to ensure that there are no litter traps which would make cleaning the vehicle difficult. Units are air-conditioned throughout by two roof-mounted air-conditioning units fitted to each passenger module, as well as one in each cab.

Each tram is made up of a number of interlinking modules. Faults which occur can be isolated at module level and an exchange unit quickly substituted. Equipment is reliable and easily accessible from outside, helping to cut repair times and keep the interior free from dirt and grease.

Safety

The EUROTRAM has a number of extra safety features. Its design recognises the problems of operating rail vehicles in the midst of road traffic. The possibility of accidents is greatly reduced by giving the EUROTRAM driver a superb field of view through a wrap-around windscreen and by placing a set of wheels directly under the vehicle's front end so it does not swing unexpectedly on curves. The driver also benefits from having his or her main controls located within the armrests of the seat and a CCTV monitor is a standard fitting to ensure passengers are clear of doorways before they are closed. The cab is fully enclosed and protected by a glass door, which provides a clear view of the vehicle interior.

Project planning

A 'project' may be defined as a planned undertaking. They are clearly distinct from 'flow shops' which yield high output at low cost. The issue for any Project Manager is to introduce a methodology to enable a complex project, such as the construction of the EUROTRAMS, to be managed in a way which enables it to meet a range of key objectives. In any well managed project:

- project objectives will be shared by participants
- steps in the project will be designed to meet specific results
- duplication of activities will be eliminated
- decisions should be shared
- the project will move through a range of phases.

In a traditional functionally organised project, the sequence of activities will be determined by each phase following the awarding of the contract. After the Sales and Marketing department has obtained the contract, it might then take 24-30 months to complete and thus be determined by lead times from engineering, purchasing and assembly.

Competitive advantage

A short development time provides organisations with many competitive advantages. For the completion of the EUROTRAM project, Adtranz divided the project into a number of project teams, with each geared to meeting specific project objectives. Each team comprised a member of engineering, purchasing and assembly, as well as a member from one other area. In giving teams responsibilities and goals, Adtranz was creating a flat organisational structure which provided individuals, through the creation of teams, with more 'ownership' of key aspects of the project, in a way which was controlled through goal management. Thus a process of simultaneous engineering had been created which combined traditional functions through a process of goal planning. In this way, Adtranz could improve the efficiency of operation and complete the project in around half the time.

The EUROTRAM project placed all the teams in a collaborative environment under 'one-roof', where everybody on the spot could view, not only their own individual contributions to the project, but also the project unfold and develop as a whole. The UK has played a major role in the production of EUROTRAMS for Strasbourg. Around three quarters of the project has been managed by Adtranz UK, with a quarter being allocated to Adtranz Italy, the traction and control supplier for the powertrain control. Materials for the project have been sourced from around Europe including France, Holland, Germany, Switzerland, Italy and Finland.

Conclusion

To many people it seems ironic that cities like Strasbourg are returning to a form of transport discarded during the 1950's and 60's in the post-war rush into motor vehicle use. However, a moments' thought makes the logic of this change clear. Electricity is one of the cleanest fuels and is relatively easy to generate and sustain within a localised area e.g. within a large metropolis. Diesel and other forms of fuel-driven public transport were a disaster for the environment - they were dirty and noisy and polluted the clean air which lies at the heart of our urban ecosystems.

You have only to study the pictures of the trams of a hundred years ago and modern trams, such as the EUROTRAM, to appreciate their aesthetic nature. Designers, such as Phillippe Neerman, have created modern tram systems which are pleasing to the eye, blend in sensitively with the local environment and provide a cheap, pleasant and reliable way to travel. It is little wonder that trams are going through a period of renaissance. Many people are eagerly looking forward to the time when their city takes the plunge into creating a new form of transport system. We will all benefit from a development which provides a positive improvement in the quality of our lives and contributes to the sustainability of our planet.