Tirana LRT PPP – Strategic Review of Basic Options







Tirana LRT PPP Strategic Review of Basic Options

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TABLE OF CONTENT		PAGE
1	FRAMEWORK AND SCOPE OF THE PROJECT	1
2	SCHEDULE OF SITE VISIT	2
3	CITY PLANNING AND GENERAL DEVELOPMENT CONCEPTS	3
4	TRAFFIC AND TRANSPORT	5
5	LRT PROJECT	8
5.1	General	8
5.2	Network and technology	8
5.3	Organisation	9
5.4	Actual Terms of Reference	10
6	EVALUATION OF ACTUAL SITUATION	12
7	OPTIONS FOR THE DEVELOPMENT OF AN LRT SYSTEM	15
7.1	City planning and politics	15
7.2	System	16
7.3	Definition of the Project – Organisation	16
7.4	Financing	22
7.5	Implementation – Definition of Tasks	24
7.6	Cost estimation	28
8	CONCLUSION	33
9	SOURCES AND DOCUMENTS	34



FIGURES	PAGE
Figure 1: Structure of city administration of Tirana	4
Figure 2: Planned LRT network	8
Figure 3: Levels of responsibility	17
Figure 4: Components of LRT system	18
Figure 5: Option 1	20
Figure 6: Option 2	21
Figure 7: Organisational set-up option 1	21
Figure 8: Organisational set-up option 2	22
Figure 9: Financing scheme	24
Figure 10: Schedule and structure for project preparation	25

TABLES	PAGE
Table 1: Modal split (Instat survey, 2004)	5
Table 2: Examples for various project configurations	18
Table 3: Estimation of investment costs (all costs in Euro)	29
Table 4: Estimation of operation costs (all costs in Euro)	30
Table 5: Public transport fares in relation to average income (in Euro)	31
Table 6: Assessment of farebox revenues (in Euro)	32



1 FRAMEWORK AND SCOPE OF THE PROJECT

Since the political change in 1990, Albania is in a process of radical changes in terms of political, economic and social issues. In recent years significant progress has been made in the convergence of Albania to standards of the rest of Europe. Consequently Albania has formally applied for EU membership in April 2009.

Tirana, being the capital of the country, has undergone an even more significant process of change. A very high immigration rate from the rural areas to the capital has made the Tirana area to one of the regions with the highest growth rates in Europe. The number of inhabitants at the end of the 80s has been around 200,000, since then an extremely fast growth has taken place. The current number of inhabitants is estimated to be around 800,000 in the city itself and about 1.2 million in the metropolitan area. This development requires significant modernisation and extension of urban infrastructures. Amongst others, the introduction of a modern LRT project is seen as a major project to improve traffic and transport in Tirana.

First ideas for an LRT have been discussed in the City and with EBRD. The plan is to establish a basic network in the city and to contract one or several companies who will be responsible for the implementation and the operation.

This assignment has the purpose to analyse the current situation, to develop suitable options for the future process and to refer to comparable situations in Europe or elsewhere. The overall objective is to structure the project adequately and to allow EBRD to decide about a possible future involvement.

This short report is organised as follows:

- Chapter 1: Introduction
- Chapter 2: Schedule of site visit
- Chapter 3: Short description of actual situation Tirana and Albania
- Chapter 4: Description of traffic and public transport in Tirana
- Chapter 5: Description of planned LRT project
- Chapter 6: Evaluation of actual situation and plans by the author
- Chapter 7: Recommendation for structuring the project and organisation of the implementation phase
- Chapter 8: Conclusion



2 SCHEDULE OF SITE VISIT

A site visit has been performed from 19th to 22nd December in order to gain an impression of the local situation and to collect available information from first hand.

Monday, 19.12.2011

Travel and arrival at Tirana, familiarisation with existing documents, papers of EBRD, Draft of ToR by City of Tirana

Tuesday, 20.12.2011

Meeting and discussion with Henrik Hysenbegasi, General Director, General Directory of Strategic Projects and Foreign Investments

Extensive site visit with Urim Hoxha, Engineer in the General Directory of Strategic Projects and Foreign Investments

Wednesday, 21.12.2011

Meeting with Urim Hoxha and Henrik Hysenbegasi

Discussion of open questions, especially on planning procedures

Thursday, 22.12.2011

Meeting with Henrik Hysenbegasi and Nerejda Hoxha, Director of Transport and Mobility

Discussion of actual organisation of public transport in Tirana

Discussion of possible options for future organisation

Departure

All meetings have been held in a friendly and open atmosphere. All requested information has been handed over, as far as they generally existed.



3 CITY PLANNING AND GENERAL DEVELOPMENT CONCEPTS

Tirana is the capital of Albania and by far the largest city in the country. Tirana currently has about 800,000 inhabitants inside the city boundaries; the whole metropolitan area has about 1.2 million inhabitants. The numbers are not very much accurate, due to limited availability of statistics and to remarkably high growth rates. The suburbs are partly fully integrated with the Tirana city territory, so settlement structures are very compact. A further growth is expected, so that in 2020 Tirana may have a population of more than one million inhabitants.

A significant immigration to the Tirana area can be observed since the beginning of 90s, according to [1] only 36% of the actual inhabitants of Tirana have been born there (Instat Survey, 2004).

Taking into account the relatively small area of 41.8 km² the population density inside the city amounts to 19,000 inh./km². This is a remarkably high figure, comparable with the city centre of Paris and higher than for cities as Naples, Istanbul and even Hongkong. The analogue value for the metropolitan area (ca. 211 km²) is 5,600 inh./km², which is in the range of London, Madrid and other big European cities.

This fact is definitely an excellent precondition for an efficient public transport system.

The fast growth, combined with the process of fundamental changes in almost every aspect of public life raises a number of major challenges to be addressed. The most important ones are:

- Regulation of land use
- Modernisation of basic urban services (electricity, water supply, waste water, drainage, communication)
- Organisation of traffic and transport and establishment of the necessary infrastructure
- Implementation of basic standards concerning environmental protection

A first masterplan for the City has been prepared in 2007/08 [2], but has never been approved formally. It was reported that also the City budget in recent years was not officially approved.

In the middle of 2011 a political change took place, and a new Mayor, Mr. Luzlim Basha (who has been Minister of Transportation in 2005-08, and Minister for Foreign Affairs and of Interior afterwards) has started his work. It is envisaged that the city budget for Tirana will be around 80 million Euros in 2012, which is considerably low for a city of this size and less than a tenth of the budget of a German city of the same size.

However, the City prepares itself in order to tackle the main challenges described above and to promote new programmes and concepts.

A new masterplan is currently being prepared. According to Albanian law the establishment of a masterplan is obligatory for all municipalities in Albania. Projects as the LRT need to be included in the masterplan, and then the plan is the legal basis for detailed planning steps.



The new masterplan for Tirana is expected to be finalised in May 2012. The City then intends to go on with the planning process for the LRT (as laid out in the ToR for an LRT consultant).

As mentioned above, Tirana is embedded in the metropolitan area of Tirana which consists of the City of Tirana and seven major municipalities. Currently there is hardly any cooperation between these municipalities and the City of Tirana. On the 20th December 2011 the Mayor of Tirana has had a meeting with the mayors of the neighbouring municipalities to discuss a possible closer cooperation. A general agreement has been concluded, which includes a cooperation to work out the masterplan and to intensify collaboration in transportation issues.

The following figure shows the organisation of the city administration in Tirana (structure of 2008). Basically the LRT project shall be organised through the Directorate of Strategic Projects and Foreign Investments, which is not included in the diagram. Obviously this Directorate is directly working with the Mayor. All public transport issues in the City are further organised in the department (Directorate) of Transport & Mobility.



Figure 1: Structure of city administration of Tirana

It is reported that the planning law is rather similar to European standards, respectively will be modified accordingly. This is determined by the approximation process towards the European Union. With view to the planned LRT project this means that all relevant environmental and social standards will have to be followed resp. investigated.



4 TRAFFIC AND TRANSPORT

Compared with other European cities the availability and the use of private cars are relatively low in Tirana. However, taken into account the underdeveloped road network, limited parking capacities and poor traffic regulation, already now the traffic situation is quite bad. Main roads are often congested (not only in peak hours), public transport buses are trapped in congestion, and therefore cannot offer attractive alternatives.

Although quite out-dated in the meantime, the Instat figures of 2004 [1] give a good overview over the traffic situation in Tirana:

Mode	Trips to work, school	Trips for leisure and other purposes	
On Foot	42.0 %	43.0 %	
Public transport	32.0 %	25.1 %	
Private car	23.0 %	30.0 %	
Bicycle	2.4 %	1.3 %	
Motor bike	0.6 %	0.6 %	

Table 1: Modal split (Instat survey, 2004)

At that time the availability of private cars was still relatively low: about 14 % of all households had one (or more) private car. The number of cars per 1,000 inhabitants was still below 100 at that time. Currently this figure has risen to about 200, leading to serious problems in the city network. It is easy to see that a further development to European standards of >400 cars per 1,000 inhabitants would result in a complete standstill.

The traffic discipline is low to moderate, basically comparable with other countries in the region, Main problems are parking in second row, red light violation, and not respecting the (few) separate bus lanes.

Apart from the main roads, which are in comparably good conditions, the network is in a bad status and not properly developed (no clear hierarchy, often dead ends because of illegal buildings, etc.)

Some bus lanes exist, which originally have been designed as emergency lanes. As they do not cover all critical sections and are often used by other traffic, their benefits are limited.

The public transport in Tirana is based on a classic bus system. The network currently consists of 10 lines, which are basically radially organised and which all cross or approach the city centre.



One of the bus lines (line 1) is operated by the City itself. This is line 1 from Kombinat to Kinostudio (which at a later stage shall be replaced by the LRT, see next chapter). The responsibility is with the Directorate for Transport & Mobility (see organisation chart in chapter 3), which owns the buses and employs the necessary staff as drivers.

The other bus lines are run by various private operators. Operation is done on the basis of a concession issued by the City. The concession was initially given for three years; extensions are now agreed for a period of five years. Up to now the concessions have been handed out on the basis of an application of the former concession holder. If an existing concession holder does not apply for a new concession it is planned to tender the new concession in an open competition.

There are no subsidies by the City, also not for the public operator. The City is of the opinion that the costs are covered by ticket revenues and adequate profits can be made.

In total there are about 300 buses in operation currently. The buses are rather new and most of them comply with the EURO 5 standard.

The responsible Directorate for Transport & Mobility of the City of Tirana checks quantity and quality of the bus services regularly.

The current ticket price is 30 Lek (about 25 cents) per trip. Tickets are valid for one line only; passengers changing between lines need to buy an additional ticket. Monthly tickets for one line cost 900 Lek, general monthly tickets are 1,200 Lek. Students pay 600 Lek, certain groups as disabled and veterans can use public transport for free. It is reported that associations hand out disabled certificates too often, so the number of these passengers is increasing (about 40,000 now). Apparently the operators do not get any compensation for the transport of these groups.

Students are an important group of public transport users. Currently there are about 60,000 to 70,000 students in Tirana, but the number may increase to 100,000 in the near future.

Ticket fares are set by the Ministry of Finance (Directorate of Taxes) and Ministry of Transport, who are responsible for all transport fares in the country.

The neighbouring municipalities currently run own bus lines to Tirana, partly in competition to urban lines. A better coordination between the responsible administrations is currently on the official agenda (see also chapter 3), and will be crucial for the planned LRT system.

The current network is limited to the mentioned 10 bus lines. As these are partly bundled in the main roads, it is obvious that the coverage area of these bus lines is limited and does cover significant areas of the city (> 400 m walking distance to the next bus stop) [4].

In addition to the mentioned bus services there are special services (mainly by minibuses) for workers, students etc., which are run for special purposes but which are not open to the public. A system of minibuses (dolmush type) which is open for all passengers does not exist in Tirana.

A number of national bus lines are operated to serve connections between the major cities in Albania. Tirana is of course the most important destination for such services. About 20 cities in Albania can be



reached directly by these bus lines. Currently there is no central bus station for this type of service. As a result the buses somehow disperse into the urban road network, adding additional traffic to already congested sections and causing difficulties for passengers to find the right bus.

The railway system in Albania is currently not very much developed. It is of limited use for long distance transport and does not fulfil any functions in the metropolitan area of Tirana. Only one railway line leads into central Tirana and ends at the northern end of the Boulevard. There are only a few trains per day which currently arrive at Tirana.

To evaluate future transport solutions it is worth mentioning that diesel prices are on the same level as in the rest of Europe. Diesel produced in Albania directly is of minor quality.

Electric power generation is mainly based on hydro energy (98 %) and is comparably cheap. For an average household the costs are around 10 ct per kwh.

Currently a number of major projects for traffic and transport are being prepared or are already in the implementation phase:

• Ring road

The road is already partly in service, some sections are under construction or in a final planning stage. It is expected that this ring road will relief the city centre from significant traffic volumes.

• Bus terminal

It is planned to build a central terminus station for all national bus lines coming to Tirana. An area north-west of the city centre, close to the municipality of Kashar and adjacent to the railway line, has been chosen for this purpose. The area has a size of 85,000 m². The project will be organised as a PPP project, in which the private partner will construct and operate the terminal. The site can be developed to a major transport hub, as it is planned to build the LRT line 2 up to this station and possibly to build a new railway (terminal) station here as well.

- UTC Urban Traffic Control
 It is planned to introduce a traffic management system, which is able to improve the traffic control. The project includes the replacement of all existing traffic lights, introduction of CCTV, and a central control room. The implementation phase is scheduled for 18 months. Currently the procurement is under way and will be finished in January 2012. The tenders will be opened on 20. January.
- LRT Light Rail Transit system This project is described in detail in the next chapter.

Other projects which may have an effect on traffic in Tirana in the future are:

- Further extension of the airport
- Extension and modernisation of Durres port



5 LRT PROJECT

5.1 General

This chapter provides a short description of the LRT project as it is currently planned by the City of Tirana. It does not include any evaluations or corrections from the author's side. These are summed up in the subsequent chapter 6.

The actually intended LRT scheme has been described in the a.m. report [1].

The report discusses a number of technical issues and ends with a recommendation for a technical concept and a possible line network. Obviously these results have formed the basis for the actually drafted ToR of the City for the further steps.

The system is a tramway type of light rail which shall run completely on surface, however, protected from other traffic modes. It is planned to operate low floor vehicles of standard type.

5.2 Network and technology

The basic network will consist of two lines which will cross in the city centre. The next figure shows the location of both lines.



Figure 2: Planned LRT network



Line 1 runs mainly in east-west direction (Kombinat to Kinostudio) and has a length of 9.4 km, with a possible extension to the station of the funicular, which would be 1.3 km long.

Line 2 would run in north-south direction (Bus Terminal to Mother Teresa Square) and has a length of 6.4 km, with a possible extension to the Student City in the south (additional length is about 1.5 km). This line would use the existing railway corridor from the northern end of the Boulevard to the planned bus terminal station.

A depot is currently planned at the western end of line 1, close to the terminal station of Kombinat.

The expected numbers of passengers are 60,000 per day on line 1, and 40,000 per day on line 2.

It is assumed that ticket prices may be higher than for the current bus system, as the provided quality will be higher. According to city officials prices could be around 60 ct for a single trip.

The current bus line 1 would be completely replaced by the LRT line 1. It is further planned that the bus system will partly be transferred to a feeder system for the LRT.

The main technical parameters of the LRT system are as follows:

- Standard gauge 1,435 mm
- Route on reserved and protected lanes
- Low floor vehicles, length between 32 and 38 metres, width 2.65 metres
- Platforms with height 30 cm, length 50 metres, width > 2.50 metres
- Power supply with overhead line, 750 V DC
- Depot for up to 50 vehicles
- Control and communication system according to actual international standards
- Barrier-free access to the system

During discussions it was mentioned that used vehicles may also be an option. Low costs for the system shall be an important feature, with, at the same time, adequate quality. For instance it was mentioned that air condition in the vehicles may not be necessary for Tirana.

5.3 Organisation

In terms of organisation of the project there are a number of basic approaches but no clear concept from the side of the City.

Basically it is planned to implement the project under a PPP scheme as DBOT (Design-Build-Operate-Transfer) or similar. All major technical components including the rolling stock shall be supplied by a private concessionaire. Operation shall also be performed by a private concessionaire. The responsible persons at the city administration seem to be open whether this project should be done by a single concessionaire or whether it should be split up into various components.

The City expects that a pay back of initial investments can take place in 10 to 15 years.



In order to make the project more attractive for private parties it is foreseen that a number of additional income sources will be generated.

- Besides the usual possibilities of advertisement at vehicles and stations the concessionaire shall be able to install additional communication lines along the tracks and rent them to communication companies.
- Further an existing hydro power plant (5 MW) at the eastern end of the city could be handed over to the operator for free and could be integrated into the system power supply.

It was stated that subsidies by the City are generally possible to a certain extent but preferably should be limited to the start-up phase of the system.

Another option which may influence the general organisation of the project is the possible integration of the LRT with the planned terminal station.

From the side of the City the costs for the LRT system (including rolling stock) are estimated in the range of 120 to 150 million Euros for both lines but without the mentioned extensions.

In terms of a necessary supervising organisation (for safety of the system) it is planned that the Ministry of Transport of Albania shall take over this function. Inside the Ministry there is currently an Inspectorate for Railways which could take over this task. It was reported that all organisations related to the Albanian railways are currently in a process of restructuring. This is related to the fact that network and operations will be separated in the future.

5.4 Actual Terms of Reference

The City has prepared Terms of Reference, aiming to hire a consultant who can work out the overall concept and establish a design for line 1 which is suitable for the procurement of detailed design, construction and supply of all system components.

The ToR include a general description of the traffic situation in Tirana and the basic parameters for a future LRT system. Two main tasks are described:

- A. For line 1 establishment of Feasibility Study, Preliminary Design, Detailed Final Design, Tender Documents on the basis of the described corridor from Kombinat to Kinostudio. Work shall include traffic projections, verification of the alignment, environmental impact assessment, estimations of all costs for construction, operation and maintenance. All civil structures and technical components are to be covered, as well as the operation program.
- B. For the entire LRT system establishment of a feasibility study and 5 year development plan. The feasibility study shall cover a 30 years horizon. It shall contain transport analysis, various scenarios, analysis of opportunities and constraints on the territory of Tirana, definition and verification of the new public transport system, cost estimations, environmental impact study, economic evaluations.



Services to be delivered further include surveys and site investigations, value engineering, health and safety plan, road safety impact audit, and a system safety audit. Further a contract scheme for the relation between the City (employer) and a concessionaire shall be established. Operation over the concession period is not covered explicitly by the ToR.

All described services shall be finalised within 8 months after start of work.

The ToR are currently in a draft status, and this report will include recommendations for modifications.



6 EVALUATION OF ACTUAL SITUATION

This chapter gives a first assessment of the actual situation concerning the LRT project from the author's point of view.

In general the concept for the LRT system is reasonable and adequate for Tirana and the traffic situation. An important motive which is stressed by the City is the objective to implement a costeffective and efficient solution. The planned corridors have been visited and it seems possible to incorporate the LRT with adequate efforts. Concerning the possible extensions the inclusion of the Student City seems to be a good concept, whereas the line to the funicular would be difficult to construct and is probably of limited use in terms of transport.

A number of technical and planning issues, however, should be discussed and investigated in early phases of the project. These are for instance:

• Coordination between length of vehicles and station length

The suggested vehicle length of 30 metres is suitable and offers a wide range of possible brands and types form the market.

The current ToR mention a vehicle length of 30 metres and a station length of 50 metres. This does not fit together. Either the station length should be reduced to 30 m (+ a few metres to cover various vehicle types) or it should be extended to allow for train operation with two-vehicle trains. On the basis of the projected passenger volume of 60,000 per day it can be said that (as a rule of thumb) the maximum peak hour load in one direction is around 4,500 passengers. Taking into account a maximum capacity of 200 passengers per vehicle, the necessary headway would be below 3 minutes. Such short headways are challenging in terms of operation and may cause disturbance of other traffic modes. It is therefore recommended to design the infrastructure according to a 2 car train operation or at least design the stations in a way that they can be extended at a later stage without high efforts. This recommendation of course is only valid as long as the passenger projection is in the correct range.

• Vehicle width

The ToR determine a vehicle width of 2.65 m which is a standard value and would allow a wide choice of vehicle types. In discussion it was mentioned that possibly smaller vehicles would ease incorporation of the tracks into the urban environment. This is basically correct but would reduce the choice of vehicle types on the market and of course also the transport capacity, leading to denser headways or longer trains.

• Size and location of the depot

The envisaged depot location is a bit remote in the network, however suitable. It needs to be clear that the depot has to be tailored to the chosen vehicle type and should inherit sufficient capacity for later extensions of the system. This primarily applies to the workshop, for



stabling other alternatives may be possible or even preferable (in order to reduce empty runs).

• Crossing with line 2

The initial network includes two LRT lines which cross in the city centre. It is necessary to take this into account when the design for line 1 is made. The crossing design should allow for all routing options in order to allow for maximum operational flexibility. Further the adjacent stations should be designed for the transferring passengers.

• Comfort equipment

From the authors point of view an air condition should be part of the vehicle's equipment taking into account the relatively warm summers in Tirana. The additional costs are moderate and the system needs to cope with the probably increasing comfort requirements by the passengers.

• Option of used vehicles

During discussions it was mentioned that used vehicles could be an option to reduce costs. Basically this approach is correct. Two aspects have to be taken into account:

- As the low floor technology is still a (compared with the life cycle of LRT vehicles) rather new technology, only high floor vehicle will be available for this purpose. This would mean restrictions towards the objective of a barrier-free system.
- Fixed infrastructure and rolling stock need to be adapted to each other. It will be important to design the infrastructure in a way that no restrictions occur towards actual vehicles, which may be introduced at a later stage.
- Protection from other traffic modes

The planned design includes a wide-ranging separation of the LRT system from other traffic modes. This will be a crucial element for the success of the system. Taking into account the rather dense headways and the high occupancy of the roads it will be a challenging task for the urban traffic control to keep the intersections clear of car traffic when an LRV approaches.

Apart from the technical and planning items which were mentioned above the future process of implementation needs to be discussed more in detail.

The Terms of Reference currently include the development <u>and</u> the execution of a concept. Further a number of investigations are included, and the results thereof will significantly determine the subsequent effort (e.g. soil investigations).

It is probably very difficult for any consultant to calculate such a project realistically. The envisaged time period of 8 months is by far too short with view to the expected results. One needs to be aware that the LRT will strongly influence the city and its development in the long term (> 50 years) and will



have numerous implications. Therefore an adequate preparation is advisable. Although an LRT network as the one presented here will definitely help to improve the city's traffic situation, it should be seen as a first step into a larger network. Compared with other cities of the same size the initial network of 16 km would be very small.

Taking into account the high population density of Tirana, an estimation from the author's point of view is, that a complete network would have a length of about 50 to 70 km.

It should further be mentioned that the implementation of an LRT system often goes in line with other measures for the city development, modernisation of urban structures, etc. This should be taken into account at least, and possible projects should be integrated into the planning process.

In general it is suggested to take out detailed design work from the project preparation phase and leave this for the concessionaire's consortium.

It is therefore recommended to restructure the approach documented in the ToR and to divide the content into manageable components.

This approach is described in detail in the next chapter, supplemented with some rough cost estimations.

A number of side aspects which have been mentioned before will need to be investigated more in detail in next phases:

- The idea of renting communication lines may be a good one, but it will for sure need communication experts to assess the technical and financial scope.
- The integration of the hydro power plant is basically also a good approach but may lead to complications, if a concessionaire would have to take over the plant directly.
- Giving the situation in Albania with Tirana being by far the biggest conurbation in the country, it would make sense to allocate a supervising and regulating body for the LRT at the City directly, instead of a nationwide organisation.



7 OPTIONS FOR THE DEVELOPMENT OF AN LRT SYSTEM

This chapter aims to describe some basic options how the LRT project can be structured. The first two sub-chapters include some general statements concerning the integration of the system into the city planning and the basic system parameters. Subsequently the stress is put on structuring of the project and cost estimations.

The baseline for all concepts is that a significant part of the project shall be implemented by private parties.

The main objectives can be described as follows:

- Open competition to generate best value for money (\rightarrow keep to standard solutions)
- Attraction of seriously interested concessionaires (→ achieve fair distribution of risks, and avoid putting risks to private partner which are not manageable)
- Risks must be bearable by private partner; otherwise risk surcharges will be too high
- Influence of the City in terms of transport policy, expanding of system, etc. to be maintained
- System must be affordable for users, also for poorer groups (there will be no buses left for the main corridors)

7.1 City planning and politics

Due to the geographical proximity of Tirana and the neighbouring municipalities it is essential that cooperation between them will be established. The inhabitants of these municipalities form an essential part of the transport demand, so LRT and bus services need to be coordinated with each other. This includes the coordination of the network, the layout of transfer stations and the coordination of necessary transport capacities.

Taking into account the already difficult traffic conditions in Tirana it can be expected that the pressure on the City to provide sufficient road space will increase. It is essential for the success of the LRT that the system will have separated tracks and is sufficiently protected against other traffic modes. With view to actual traffic behaviour it will be necessary to physically separate the tracks from the rest of the road space. A clear policy of the City is essential which guarantees these conditions in the long run.

An improved road space management should go in line with the improvement of public transport. It is suggested to introduce paid parking on and off streets and to ensure a proper enforcement in case of violations. This would be one element to bolster public transport and to generate additional financial sources for the city.

It is recommended to establish a small group of competent employees at the City which is able to control the whole process and which can serve as a main contact point for consultants, suppliers, operators, etc. This group may be supported by consultants especially in the initial phase (PIU – Project Implementation Unit).



7.2 System

The following technical parameters shall give a framework for the future concept:

- Standard gauge 1,435 mm
- Route on reserved and protected lanes
- Low floor vehicles, length app. 30 metres, width 2.65 metres
- Platforms with height 30 cm, length 60 metres, width > 2.50 metres
- Maximum driving speed 50 km/h for most sections, vehicles should allow for 70 km/h
- Commercial speed > 20 km/h
- Power supply with overhead line, 750 V DC
- Depot for up to 50 vehicles, workshop for total fleet size
- Control and communication system according to actual international standards
- Barrier-free access to the system

These parameters will need to be verified in the course of the next planning stages.

7.3 Definition of the Project – Organisation

There are various perspectives to look at the project:

- Hierarchical levels
- System components
- Criteria / aspects to be taken into account

With view to the tasks and responsibilities usually three levels according to the following figure can be differentiated:

- Strategic level: Development, Standards & Regulations, Quality and Ticket Prices, Public Funding
- Executive level: Design of Systems and Infrastructure, Operation Control, PR & Marketing, Tendering & Contracting
- Operational level: Operational Planning and Scheduling, Driving Operations, Cash Handling, Staffing & Training, Failure Management, Emergency Procedures, Maintenance, General Administration





Figure 3: Levels of responsibility

Whereas tasks on the strategic level need to be allocated to public bodies / administrations, all tasks on the operational level can rather easily be privatised and contracted to a concessionaire. On the executive level it has to be decided on a detailed level how active the City wants / has to be and which tasks can be transferred to the private side.

The (physical) project can generally be structured into four basic components:

- (A) Fixed infrastructure (to be built on site)
 Buildings, station platforms, track beds (without trackwork), cable ducts, bridges, retaining walls, etc.
- (B) Technical components (to be delivered and installed by suppliers) *Trackwork, substations, overhead lines, communication systems, control systems, etc.*
- (C) Rolling stock (to be delivered by supplier)
 Vehicles for commercial operation and other rail vehicles (for maintenance tasks) if necessary
- (D) Operation and maintenance (to be performed locally)
 Day to day operation, maintenance of all components, including fixed infrastructure





Figure 4: Components of LRT system

In principle it is possible to handle all the above mentioned components (A) to (D) separately. In reality the project will become more complicate the more components are handled separately, as the responsibility for the interfaces will remain with the City.

In general it is possible to privatise the whole process of implementation, operation and maintenance of the system. There are various examples for different combinations as shown in the table below:

Example	Infrastructure Rolling Stock		Operation
Nordwestbahn, Germany (regional railway)	Employer	Employer	Private
Southwest trains, UK	Employer	Private	Private
Bangkok BTS, Thailand Jerusalem LRT, Israel	Private	Private	Private
Berlin LRT, Germany	Public	Public	Public
Athens Tramway, Greece	Package 1	Package 2	Public
Delhi airport shuttle, India	Package 1 (split up into several contracts)	Package 2 (Rolling Stock + systems)	Package 2

Table 2: Examples for various project configurations



All these configurations have been implemented successfully. It is not possible to generally judge one option over another one. It is always necessary to adapt the solutions to the actual objectives, boundary conditions, legal framework, etc.

As the LRT in Tirana would be the first urban rail system in the country and as Albania does not have a specifically experienced industry in this sector it is recommended to take only the fixed infrastructure into account for a direct involvement of the City. The remaining components (B) to (D) would in this case be organised by a private partner. This private partner can be a consortium of several companies / suppliers, but it is strongly recommended that this consortium takes the full responsibility for its part of the project.

Further services to be taken into account in the project framework are amongst others:

- Electric power supply (medium voltage level)
- Transport planning, integration of public transport (with bus operators)
- Traffic organisation, especially control of intersections
- Supervision and regulation

These services will have to be provided by the City resp. by city-controlled units.

The following criteria are proposed for an evaluation of possible configurations. As the City is the holder of the project, the criteria are described from the City's point of view.

• Maintaining the influence of the City

It is necessary that the City needs to have the last decision in strategic questions, i.e. development of network, ticket prices, coordination with other transport and traffic modes, quality standards, quantity of service offer.

- Public subsidies / investment The objective of the City is that as few money as possible shall be spent for the project. This determines higher prices for the passengers and lower costs for the operators.
- Quality of public transport An attractive public transport system is an overall objective. This means an adequate service offer, reliable operation and a good quality of stations, vehicles and technical systems (i.e. information systems)
- Complexity of interfaces A modern transport system is a very complex matter. Major interfaces are to be managed between various system components as well as between the system and other stakeholders.
- Local content

It is desirable from the City's point of view to ensure a certain local content in order to generate local business, encourage local industries and to build up local competence.



Attractiveness for the private sector

A project is attractive for the private sector, when it allows for a suitable profit. Risks must be manageable and need to be in a reasonable and fair relation to profit opportunities. The concession length has to be in a reasonable relation to the investment and risks taken by the concessionaire.

- Encouragement to deliver high quality In an ideal case the project is organised in a way that the concessionaire has specific interest to deliver high quality; usually this is the case when the concessionaire can generate profit from this higher quality (e.g. by selling more tickets).
- Complexity of process to change concessionaire
 Concessions are usually contracted for a limited period of time. From the beginning the process at the end of the concession needs to be clear. This has to cover the procedure itself, questions of ownership, status of infrastructure and systems, take-over of operational staff, etc.

Taking all this into account, two major alternatives are sketched here. Tasks which are taken over by the public side are marked green; those to be taken over by private partners are marked red.

1 Limiting the City role to a minimum

The role of the City is limited to the minimum, however maintaining a basic influence on the project



Figure 5: Option 1

2 Active role of the City

The City takes over more tasks and responsibility in the framework of the actual situation.





Figure 6: Option 2

The main differences are that in option 2 the City is taking responsibility for the fixed infrastructure and that it takes over certain tasks of the executive level. These tasks should be certain steps of the system design and the procurement process.

A third option can be a combination with the City having a more active role on the executive level, but leaving the whole technical system implementation to a private concessionaire. It needs to be noted that the public transport with buses has to be organised as well and has to be integrated with the LRT scheme.



For the first two options different organisational set-ups have to be chosen.

Figure 7: Organisational set-up option 1





Figure 8: Organisational set-up option 2

It is obvious that in option 2 there are a number of interfaces which have to be managed properly. Taking into account the actual organisation of the city administration and the remarkable number and complexity of projects to handle in the near future (see chapter 4), it is recommended to follow basically option 1 and to limit the efforts of the City to a manageable extent. The detailed task assignment to the Department of Public Transport / PIU should be a task to be investigated in detail during the next project stage.

7.4 Financing

Financing the LRT project is one of the crucial issues. In general it has to be distinguished between the capital expenditure for infrastructure, systems and rolling stock and the expenditures for operation and maintenance. The concessionaire has to take into account all relevant costs, cost developments over the contract period, revenues (from tickets and others) and will offer a price for which the system can be implemented and operated. It is recommended that this price will be paid in the form of regular (monthly, yearly or other periods) payments over the contract duration.

There are various options for the Concession Contract, whether to put the revenue risk on the private side (net contract) or on the public side (gross contract), how to implement incentives for the concessionaire, etc. All these parameters have significant influence on the risks for the concessionaire and therefore on the price which will be offered.

Following option 1 as described above, this will mean that the financing is basically in the hand of the concessionaire, whereas option 2 will inherit a split up of costs into certain payments to the concessionaire and a direct financing of the fixed infrastructure.

A special issue has been raised in the discussions of the City with EBRD: the option of export financing for rolling stock or other system components. This type of financing may offer favourable



conditions for financing of certain components, on the other hand the choice between various suppliers will be drastically limited to such of the respective country providing the financing.

Such type of financing would therefore limit competition significantly. It would need to be investigated if and how such type of financing can be integrated with the general approach of having one overall responsible concessionaire. If this would not be possible, this would mean that the City would provide certain components (e.g. rolling stock) for the project, which then would cause a number of additional and probably complicated interfaces. It is doubted that the benefits of "cheap financing" would compensate the results of limited competition and additional efforts to manage the interfaces.

It is suggested to orientate the financing along the following basics:

It is unlikely that, given the actual situation in Tirana, a consortium is willing to take the full revenue risk. The city is a process of major changes, the database to predict future passenger volumes is rather limited and future developments are hard to assess reliably.

It is suggested that financing from the side of the City / public sector is structured into a grant for capital expenditures (to be paid during implementation) and operational expenditures (to be paid regularly throughout the operation phase).

Interested concessionaires have to offer a price which consists of capital expenditures (share of or complete grant) and a regular payment to cover the full operation costs. It is further recommended to integrate financial incentives into the contract. On one hand this should inherit a "malus" component in case the concessionaire delivers a low performance (availability below agreed levels, insufficient quality). On the other hand the contract should include a positive incentive in case more passengers than defined as a baseline are transported by the system.

The following figure shows the described structure.





Figure 9: Financing scheme

7.5 Implementation – Definition of Tasks

The above mentioned recommendations mainly reflect the first impressions of the author and experience from other projects. A proper implementation schedule will integrate a more detailed investigation of these questions and will include suitable decision points for the City.

The following figure intends to give an overview over the main preparatory modules prior to the start of system implementation. It is envisaged that international consultants will be hired for these tasks who will cooperate with suitable local companies and who will closely work together with the City of Tirana and other relevant stakeholders.

It is anticipated that the procurement process can be initiated 12 to 18 months after start of the described activities. The masterplan which is currently being worked out shall include a basis for the LRT concept and include general objectives and a framework for the future LRT concept.

The concept itself, together with a feasibility study needs to be established separately. This should be focussed on the technical and operational issues. It shall be followed by a reference design which is suitable to serve as a basis for procurement and an Environmental and Social Impact Assessment.

In parallel work should start on the organisational concept and the preparation of the procurement. This needs to include the investigation of various options concerning financing, contracting, role of City, etc. It is suggested to establish a Project Implementation Unit (PIU) which can support the City of Tirana through this process. The structure and timetable of these activities is shown in the figure below.





Figure 10: Schedule and structure for project preparation

The following contents need to be covered in the various modules:

Strategy / Masterplan (already in preparation)

The following issues should be integrated into the masterplan in order to provide a sound basis for the LRT-project.

Organisation

- Tasks and responsibilities of the City
- Cooperation with neighbouring municipalities
- Implementation of framework for private concessionaires
- Regulation and supervision
- PIU Project Implementation Unit
- Staffing

Economic framework

- Necessary investments
- Operational costs and efforts
- Setting of fares for public transport
- Financing scheme



Public Transport Concept – LRT concept and feasibility

Public transport network in Tirana (LRT and bus)

- Analysis of current demand
- Projection of future demand
- LRT Network (corridors)
- Detailed design of corridor for line 1

Feasibility concept for LRT

- Definition of basic system parameters
- Functional description of main components and its parameters
- Introduction of corridors in Tirana

Basic operation concept

- Operational parameters
- Maintenance parameters
- Resources needed (staff, rolling stock, maintenance)

Long term implementation plan (stages, incl. adaptation of bus services)

- Stepwise development of network
- Time schedule
- Development of demand
- Necessary capacities for each step
- Necessary resources needs (according to steps)

Reference Design / Design line 1

Establishment of reference design for the whole network

- Definition of main parameters
- Definition of functions
- Definition of interfaces

Establishment of design for line 1

- Transfer of reference design to line 1
- Set-up of Bill of Quantities



Environmental and Social Impact Assessment (ESIA)

Environmental Impact Assessment

- Legal and regulatory framework
- Scope of environmental impacts of LRT / public transport
- Categorisation of impacts
- Localisation of impact zones
- Construction stage
- Operation stage

Social Impact Assessment

- Legal and regulatory framework
- Scope of social impacts of LRT / public transport
- Categorisation of impacts
- Construction stage
- Operation stage

Stakeholder Engagement Plan

Project Implementation Unit / Procurement

On-going support of the City

Establishment of PIU

- Tasks and responsibility of PIU (update)
- Detail staffing plan
- Hiring of staff
- Establishment of internal regulations
- Establishment of work procedures with local partners

PPP for LRT

- General strategy
- Contract options
- Risk distribution
- Legal framework
- Length of concessions
- Procedures for extension of network
- Procedures for contract termination
- Economic evaluation



Procurement of line 1

- Establishment of planned procurement process
- Preparation of all tender documents
- Establishment of selection criteria
- Launch of call for expression of interest
- Evaluation of expressions of interest, selection of suitable consortia
- Launch of call for proposals
- Evaluation of proposals

For a first approach the necessary financial resources are estimated as follows:

Public Transport / LRT Concept	150,000 Euro
Reference Design / Design line 1	170,000 Euro
Environmental and Social Impact Assessment (ESIA)	80,000 Euro
Project Implementation Unit / Procurement	1,500,000 Euro

The latter item is depending on the time period in which these services are needed and on the intensity of involvement by the City.

7.6 Cost estimation

An initial cost estimation is performed with the purpose to assess whether the preliminary estimations of the City of Tirana are in a suitable range and to assess a possible cost coverage.

As far as investment costs have been discussed until now they mainly source from the report [1]. This report includes different quantities and a slightly different network layout. The quantities have been corrected according to the former shown network and an own calculation of the rolling stock fleet, which is presented here:

As mentioned before, the number of passengers on line 1 is estimated with 60,000 per day, resulting in 4,500 per hour and direction (15% share in peak hour). On the basis of a capacity of 200 pass/vehicle 22.5 trips per hour are necessary. Assuming a commercial speed of 22 km/h (which can be taken as an average value for a "good" system), total turning time of 10 minutes and a reserve of 10% 26 vehicles are necessary for line 1. On the basis of similar assumptions (but 40,000 pass. per day) 13 vehicles are needed for line 2, resulting in a total fleet size of 39 vehicles.

The following table shows the original costs and quantities of [1] (columns 2 and 3) and is supplemented by the corrected quantities (columns 5-7).



1	2	3	4	5	6	7
Item	Total	Quantity	Resulting costs per km or item	Own estimation (per km / item)	Corrected quantities	Own estimation (total)
Municipal Utilities	5,000,000	18.2 km	274,725	275,000	15.8 km	4.345,000
Single track, antivibration	19,000,000	5.2 km	3,653,846	2,000,000	5.2 km	10,400,000
Double track, standard	13,500,000	15.6 km	865,385	1,500,000	10.6 km	15,900,000
Overhead line	5,200,000	18.2 km	285,714	350,000	15.8 km	5.530,000
Substations	6,000,000	18.2 km	329,670	500,000	15.8 km	7.900,000
Depot / Workshop	9,500,000	1 depot	9,500,000	20,000,000	1 depot	20,000,000
Stations	800,000	17 stations	47,059	40,000	30 stations	1.200,000
Traffic control system	2,400,000	18.2 km	131,868	200,000	15.8 km	3,160,000
Control centre (CC)	4,000,000	1 CC	4,000,000	4,000,000	1 CC	4,000,000
Ticketing and information	2,700,000	17 stations	158,824	200,000	30 stations	6.000,000
Rolling stock	39,900,000	21 vehicles	1,900,000	2,000,000	39 vehicles	78,000,000
Misc.	5,000,000			5,000,000		5,000,000
Total	113,000,000					161,435,000

Table 3: Estimation of investment costs (all costs in Euro)

The investment costs therefore need to be corrected to 161,435,000 Euro, say 160 to 165 million Euro. Taking into account the very early project phase and the resulting degree of inaccuracy it is suggested to add 20 % contingencies to this amount. The total investment cost would then result to 180 million Euro.

The total costs per km are therefore 5.6 million Euro without rolling stock, but including the depot (4.3 million without RS and depot). This is considerably low compared with other examples from Europe but still in a realistic range. Important preconditions are



- Civil structures and works according to local prices
- Simple standards (however good quality)
- No cost provisions for reorganising / modernisation / upgrade of road space outside the track (which is often included in new systems)

It needs to be noted that cost figures are often difficult to compare, as long as it is not clear which items are inside or outside the estimation. Taking into account various examples from central and western Europe (especially from Germany and France) investment costs range from 5 to 25 million Euro per kilometre (without depot costs).

So far the focus in discussions was mainly on investment costs. It is also necessary to have a first projection of operation costs, in order to assess the profitability of the system or the need for constant subsidies. Obviously this has to go in line with an assessment of the ticket revenues.

Item	Unit	Unit costs	Quantity	Total costs
Drivers	Yearly salary	4,800	100	480,000
Workshop staff (RS + lines)	Yearly salary	4,800	40	192,000
Administrational staff	Yearly salary	6,000	20	120,000
Maintenance infra (material)	Share of investment	59,500,000	2 %	1,190,000
Maintenance systems (material)	Share of investment	26,500,000	5 %	1,325,000
Maintenance vehicle (material)	Share of investment	78,000,000	5 %	3,900,000
Energy costs (traction)	Vehicle km	8 ct./kWh; 2.5 kWh per km 0.2 Euro/km	3,000,000	600,000
Energy costs (others)	Lump sum	30,000	1	30,000
Other costs (lump sum)	Lump sum	100,000	1	100,000
Total				7,937,000

A first estimation of operation costs comes to the following results, based on rough estimations concerning an operation concept.

 Table 4: Estimation of operation costs (all costs in Euro)



Depreciation has not been included in this first assessment. Taking into account an average depreciation period of 20 years for all investments, yearly depreciation is around 9.0 million Euros per year.

Total operation costs therefore amount to around **17.0 million Euros**.

Finally it is necessary to estimate the probable revenues from ticket sale. To get a first idea of a suitable level for the future ticket prices it is helpful to draw some comparisons from other cities in Europe. Of course ticket prices differ a lot from one country to another, depending on economic situation and social aspects. Therefore the ticket prices of some cities have been put in relation to the official average income.

City / Country	Price for single ticket (Euro)	Average monthly income (Euro)	Number of tickets for monthly income
The Hague / Netherlands	3.50	2,900	830
Hannover / Germany	2.30	2,600	1,130
Bordeaux / France	1.40	2,600	1,857
Seville / Spain	2,30	2,100	910
Porto / Portugal	1.75	1,500	860
Krakow / Poland	1.30	1,200	920
Tirana (current price)	0.25	400	1,600
Tirana LRT (option)	0.60	400	667

Table 5: Public transport fares in relation to average income (in Euro)

The possible range of future ticket prices has been discussed to be around 50 to 60 ct. On the basis of the a.m. data it can be seen that this would lead to ticket prices which are very high (in relation to the average income). Further it has to be taken into account that the average farebox revenue per passenger is lower due to

- Use of discount tickets
- Probable introduction of tickets which allow for interchange between bus and LRT (is a prerequisite when buses shall serve as feeders)
- Certain groups can use public transport for free

It is assumed that about 60 to 80% of the nominal ticket price can be calculated as income for the operator.

On the basis of the a.m. passenger demand the following income can be generated:



		Ticket Price (Single Ticket)			
		0,25	0,40	0,50	0,60
Share	80%	6.000.000	9.600.000	12.000.000	14.400.000
	70%	5.250.000	8.400.000	10.500.000	12.600.000
	60%	4.500.000	7.200.000	9.000.000	10.800.000

Table 6: Assessment of farebox revenues (in Euro)

It becomes clear that even in the case of "best" preconditions the operation costs including depreciation cannot be covered by the farebox revenues. However, the above calculation does not include any profits or risk surcharges. The above mentioned "bonuses" for the future operator (rent of communication lines, takeover of power plant) have not been quantified here. It is not expected that this will change the result significantly.

However, it is recommended to do this investigation more in detail before deciding about procurement methods and PPP models. It is stressed that the above shown calculation are very rough assessments drawn from experience and according to knowledge of the author. The basic assumptions will have to be checked in detail, local costs need to be verified and additional income sources for the operator will have to be looked at thoroughly.



8 CONCLUSION

The following statements try to summarise the main outcome of this short investigation.

The general concept of the future LRT is considered to be adequate and efficient. This applies to the main technical parameters as well as to the basic network configuration. The initial planning phase should be used to define more clearly the long-term concept, in order to avoid wrong investment decisions.

Prior to a start of detailed engineering work it is recommended to establish a clear organisational concept which includes

- The future role and organisational set-up of the public (City) side
- Concept for the establishment of adequate resources at the side of the City
- Establishment of cooperation with the neighbouring municipalities
- Investigation of PPP options and choice of the most suitable one

This concept needs to take into account the local conditions and probable developments. It is necessary to find an organisation which is able to manage the implementation phase of the LRT as well as the long term operation.

It is considered to be unlikely that operation and construction of the LRT can be financed from the farebox revenues. It is therefore necessary that the City (and possibly the neighbouring municipalities) define a possible financial contribution. It is further recommended that the State of Albania may also support the project with a capital expenditure contribution.

These aspects are closely linked with the organisational concept.

In section 7.5 a schedule has been sketched with the main steps recommended to be followed prior to the system implementation. It can be said from experience that a proper preparation will save much time during implementation.



9 SOURCES AND DOCUMENTS

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