

## **COST-BENEFIT ANALYSIS OF THE DUBLIN LUAS LIGHT RAIL PROJECT**

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The Luas is due to cut journey times from some Dublin locations in half. Planners are telling us that light rail is the solution to the increasingly congested Dublin Streets during peak times. 800million euro will have been spent on the Luas by the time it is opened in early 2004. Oliver Fegan investigates how the benefits of Luas will pay back this huge investment.

### **Introduction**

Dublin has come to a halt in recent decades due to an overwhelming increase in annual car purchases. In some periods, 1,000 new car registrations were granted a week. Numbers travelling during peak travel hours have increased from 172,000 in 1991 to 428,000 in 2002 (Keegan, 2003). Journey times in this period have increased by over 50%. To add to this woe, public transport has undergone minor adjustments in this time frame, leading to serious questions being asked and significant answers being sought. Although various alternative means of public transport were looked at, few were studied in-depth, so viable solutions were slow to present themselves. After so-called “intense research”, policy makers came to the following conclusion: the Luas Project is the answer to our problems, the golden solution or our “White Elephant”. This great hope met problems in both planning and construction, which have put in doubt the viability of further lines due to cost constraints and productivity limits.

With these factors at the fore of current Infrastructure planning debates, I sought to examine the initial Cost Benefit Analysis (CBA henceforth) undertaken on behalf of the Dublin Transport Initiative, using their conclusive figures, and analyse them against current cost and benefit estimates. In doing so I hope to shed a light for further public transport planning projects. I shall conclude my essay by looking at the alternatives we should examine in tackling the dire mess that is Dublin Public Transport.

## Foundation of Luas Plan

The need to form a plan was evident from all corners. 32% of the Irish workforce are based in Dublin. Travel demand in the Dublin area is projected to grow by 72% by 2016, reflecting a growth of population, employment, economic activity and households. (Sunday Business Post, 16/09/2001) The government has pledged over 17 billion-euro to the radical transformation of public transport services within this timeframe reflected in the NDP. This substantial figure reflects the urgency and necessity of action. The Luas Project can be traced back to 1988, when the minister for the environment established the Dublin Transportation Review Group. It had representatives from the relevant government departments, local authorities and CIE. Its aim was to review transportation policy for the Greater Dublin Area (DTI, 1994;1). In September 1991 the DTI completed a 20-year study of Dublin transport, highlighting historical trends. The second phase began in February 1992 and had three objectives:

- Creation of a LRT strategy until 2011 for the Greater Dublin Area.
- Preparation for a medium term investment and implementation programme for the period 1994-1999, drawn from the DTI Strategy.
- Putting in place a continuous transportation planning process.

With these objectives in mind, the Irish Marketing Surveys Ltd conducted both qualitative and quantitative research to ascertain public opinions and attitudes, to various forms of current and prospective transport. These public opinions were and still are important in transport planning.

**Table 1. Project Approval Ratings**

Project	M50 Motorway	Quality Bus Corridors	Expanded Dart Service	Luas LRT	Other
<b>Approval Rating</b>	92%	89%	85%	85%	76%

Source: *DTI Public Consultation 1994*

The approval ratings for the various modes of transport draw attention to the fact Dubliners in general see any potential project as a step in the right direction, hence they all score high approval ratings. When LRT project was given the go ahead, the public in general were satisfied something was at last being done to tackle the situation. In October 1994, the government requested that CIE should begin preliminary work on the establishment of the system. £200 million was allocated for

this purpose. The McHugh Transport consultants undertook the preliminary work for the project. They began to develop an environmental impact statement, on behalf of the CIE in December 1995. These were the foundations of the current Luas project, obtaining support from business and general public, but to obtain funding and political viability, the project had to illustrate its overall feasibility through a Cost Benefit Analysis.

## **Cost-Benefit Analysis**

Cost-Benefit Analysis (CBA) is a “practical way of assessing the desirability of projects, where it is important to take a long view and a wide view... i.e. it implies the enumeration and evaluation of all relevant costs and benefits” (Georgi, 1973;3). The reason why CBA is used for this type of capital-intensive project is that it is good for organising expenditure according to function and performance. When undertaking a project estimated at £200 million, where operating costs will not reap profits to pay back construction costs, other benefits are relied on to balance or justify the cost. We are all aware, that we have limited economic resources to improve our infrastructure. So it is economically desirable to allocate them efficiently, in order to gain a maximum overall rate of return.

The broad range of issues, dealt with, in the CBA include ‘land-use, social impacts, environmental factors, public attitudes and technical feasibility in the assessment of different modes of transport’ (LRTVol6: 1995;12). Issues involving the cost include whether funding is sourced from, EU, national or private investment. In order for any project to get the go-ahead, it had to meet certain criteria. It had to:

- encourage economic development, regeneration and employment.
- Improve reliability and quality of travel
- Improve access in an international and national context.
- Be coherent with development plans of the city and outlying regions.
- Meet financial and time-scale goals efficiently.

According to the DTI Technical Volume 6 of the Light Rail Project, the Luas Plan exhibited these critical factors. Thus it passed the planning phase and finally entered the construction phase.

## Costs of the Luas Project

### Proposed Costs

‘The actual project costs are the value of goods & services, that are required to establish, maintain and operate a project.’ (Georgi, 1973;18) The Luas planning office estimated their actual cost would be £220 million in 1994. This figure was arrived at when a sensitivity test on capital cost of the LRT project was carried out. However this figure was quickly revised to £260 million due to additional costs. The initial cost estimate per kilometre, for the 39.3 km project was £6.6m. This is more expensive than Manchester. Sheffield cost £8.1m per km, Nantes and Grenoble both cost approximately £11.8m/km. Therefore the cost estimate was below the average of most Light rail projects. The cost figure includes diversionary public utility works, which must take place well in advance of the track laying contract, the cost of the actual track-laying contract, purchasing of land and other unavoidable costs. For many reasons the figure of cost is grossly undervalued. The £40 million rise indicated that certain elements were unaccounted for, in the initial summation, which could possibly inflate the actual cost even higher. In an article ‘Light Rail – Pricing itself beyond cost-effectiveness’, examples of British projects, which were abandoned due to the funding realities, depicted a bleak picture for British light rail. The Dublin-Luas project started escalating in price once governmental contracts were signed. San Diego, the site of the first modern US light rail project, is regarded as the model for others to follow. It followed a strategy of lowest possible cost by eliminating unnecessary frills. This £260 million figure represents the ‘no frills’ policy. However in reality, Dublin’s narrow roads would not be able to accommodate new lanes as in San Diego, hence costs began to inflate, as some frills were necessary for construction to begin (complicated diversionary works).

Connex a French firm will be operating the Luas. Therefore if operating losses are incurred they will lose money. This will relieve the government or CIE, of the task of operating the Luas, so no operating losses will affect the state.

### Actual Costs

The actual costs of the Luas, paint a different picture to that of the surreal planning optimists who said costs would be £260m. Cost estimates have escalated to €800m or £630m. This equates to just over £16m/km. This figure is nearly 300% more than expected and marks a massive failure on the part of planners. According to Ger Hannon (Strategic Planning and PR) of the Luas Office, they defend this figure, by stating ‘property acquisition prices were responsible for the hike in cost’. The main additional cost comes from city centre property acquisitions such as those on Benburb St, Mary’s Street and Capel Street corner. Inflation has been extremely

high in the Irish property market, but to account for most of the 300% is unbelievable considering some sites were purchased in the late 1990's. Due to the time delays, workers on the line were employed longer than required, with constantly increasing wages, this pushed up the wage bills, thus increasing costs. It will be 10 years from when the CBA was taken in 1994 until it is operational in 2004. In that time, the Irish Economy has progressed like never before and as such costs have increased exponentially due to the delays in construction.

On the 11<sup>th</sup> January 2002 the Rail procurement agency was set up. It took over the responsibilities of the CIE light rail project office. It was reformed in order to improve the possibilities of public private partnerships (PPP's) in order to minimise future cost. Although PPP's do not play a significant part in the first phase of the Luas project, they are increasingly more important. The European Regional development fund (EDRF) contributed 82.5m-euro per line to the Luas project through the national development plan (NDP). The Luas plan seemed attractive early on, when this 165m-euro was half the estimate of the time. But now it is only 15% of the total cost.

It has been generally assumed that the operators Connex will break even or make a small profit from their venture into management of the Luas. However historical evidence shows us a different conclusion. Cities with both Bus and LRT services had a direct correlation between the two fare boxes. Cities with low fare box to operating cost ratios for buses, tend to have a similar relationship for light rail. Dublin Bus has experienced heavy losses, therefore allowing the possibility for Luas to do likewise (however it should be pointed out Luas will be operated in private hands, unlike Dublin Bus).

**Table 2. Operating Costs covered by fare box revenue as a %**

City	LRT	Bus
San Diego	89	40
Geneva	130	69
Portland	53	30
Nantes	113	48

Source: Steer Davies Gleave DTI Tech Vol. 6

## Benefits of the Luas

### Proposed Benefits

“The proposed LRT network is forecast to achieve significant transfers (in excess of 8,000 trips in the 2011 morning peak) from car to public transport and will

bring considerable gains to public transport users". (DTI, 1995) By comparison QBC's will only attract 2,000 over 9 new bus lanes.

In order for the benefits to outweigh the costs, the monetary value of the costs (£260 million) must be outweighed by the perceived benefits. In many cases the benefits do not have monetary values, so we must ascertain what their likely value would be. Although I could not locate how the DTI office calculated their proposed benefits in the CBA (in monetary terms) and this project is not large enough to work them out for myself, I have used examples from the rail industry case study in Ireland. This provides a similar comparison to the Luas, as both aim to take market share off bus and car transportation elements of Irish society.

The government had decided they would invest the necessary funds, to tackle the congestion problem. They realised LRT would be cheaper than a metro system and provide a better service than the bus only alternative. In environmental terms, the Luas was the most-friendly mode of transport. It would greatly reduce emissions at street level, which would significantly improve city life for everyone. In a 1974 study, the cost per mile of a bus in terms of air pollution was 2.78p (Barrett, 61). In real terms it would have risen exponentially due to the recent environmental problems. Hence the Luas would reduce this negative effect of the bus. Similarly, LRT has proven to be a far safer mode of transport. In 1979, a fatality was given a value of £70,000, with the Luas reducing accidents; further benefits can be achieved here. At the least, reducing traffic on the roads might make travel safer for cyclists and pedestrians. Travel times will be reduced because of the Luas's segregated tracks. This will result in large timesavings by commuters, where they would have increased leisure or work hours, increasing their utility. The Dublin Transport Office declares the main benefit of LRT is that it is 'affordable'. They state it is the 'cheapest and best value form of mass transit' (DTO web-site, 2002). Cost estimates contradict this benefit. It has been argued that it rivals the car for convenience, offering seamless journeys and it is accessible to all disabled groupings.

Light Rail has rejuvenated its surrounding areas across the world, increasing property values and general prosperity. The Dockland in Portland Oregon has been completely revitalised due to light rail, so too has the docklands area of London in the 1980's. In Manchester and Sheffield, light rail has been particularly successful in restoring commercial prosperity in decaying towns. (LRTA Fact Sheet No.62, 1998) Tallaght and Dundrum areas of Dublin have seen progress already due to the Luas. Two new town centres have begun construction, which will lead to economic growth in their vicinity.

In an article by the Light Rail Association, an argument put forward stated, 'only rail borne modes can in practice get people out of the car'. In Manchester after the 'Metrolink' was inaugurated, 13% of passengers transferred from car travel and

55% of people on shopping excursions also switched from the car. From the experience of other cities, such as Nantes, Montpellier and Sacramento, expected levels of patronage have been greatly exceeded, once the service was put in place. This proves that the Luas should reduce car travel on its routes. However in the short run, with only 2 lines, congestion should not decrease significantly in the city centre and due to the cost, further lines may not be constructed. In saying this a technical paper published by the Australian assembly pointed out that between 1986 and 1996, 25 European cities with mixed tram and bus systems but no underground or metro increased their transit trips by an average of 20.3%. This compares with 22 bus-only cities, which during the same period lost an average of 5.6% (LRTA 2001). This reiterates the need for light rail as it will rejuvenate the Irish public transit market.

### **Actual Benefits**

‘The benefits of a project comprise of all the positive effects, less the negative effects, resulting from the realisation of the project regardless of whom they fall to. This is known as the ‘with or without’ principle. (Georgi, 1995;19) In the case of the Luas project, it is not operational so the actual benefits will not be completely in play for another year. However this theory indicates the 2,280 people, who can travel on the line in any hour, will benefit us all. According to the DTI report, the Luas will increase rush hour capacity by 19%. So travel times on these routes will improve by a similar figure, as other modes of transport should be less congested, due to the extra capacity.

Since this plans induction, positive actual benefits include the boost to social and economic prospects of the surrounding area. The Luas plan has coincided with the Harp project, to revitalise the north inner city, including Smithfield, the fruit & vegetable market and Abbey/O’Connell St area. I contacted the Inchicore/Kilmainham County Council, asking ‘how the Luas has effected their district?’ I was told the area has improved since the mid 1990’s due to the Luas. A new affordable housing scheme has been initiated. Apartment complexes and new amenities are planned for the Mount Brown and Richmond park areas as well as the infamous St Michael’s Estate area. The county council put these increases down to increased demand for the locality due to the marketability of a house near the Luas line. Between 1994 and 2001, over 16,000 new houses and apartment facilities were built in the vicinity of the Luas track in South County Dublin.

While this has served to revitalise these areas, the dramatic increases in population all along the route, could create over-congestion on the Luas in the beginning. This could result in negative press and long-term problems for the Luas. The Chartered Institute of Transport (CIT) cited in a report that the most cost-effective capacity range of light rail is between 5,000 and 15,000 passengers per

direction per hour. (CIT 1991;1) The Luas, with an hourly capacity of 2,280, on a route with increasing population, will neither be cost effective nor have large enough capacity to meet demand. Hence the proposed benefit that the Luas will soak up extra demand will not ring true. This highlights that whilst the Luas has revitalised areas, it might not induce long-term growth due to under capacity.

LRT has been most successful when it has been part of an integrated public transport network. Luas does act to integrate the services available by linking Heuston and Connolly stations. However despite claims by CIE, DTO and the Luas Office, it is not and will not be fully integrated with Dublin bus services. The use of feeder buses will not be exploited by current plans. Connex CEO Mr Antoine Frerot confirmed that if Dublin Bus was to be privatised or liberalised, they would tender a bid to operate the service. He stated they would use an 'integrated ticketing system enabling passengers to transfer onto other modes of public transport'. (Irish Times 02/12/2002)

Finally British Deputy Prime Minister, Mr John Prescott stated in 1999 that trams were too expensive and offer no solution to traffic problems. He claimed an upgraded urban bus system can do as good a job as light rail (LRTA Fact Sheet No 83, 1999). This would leave a more favourable balance for the CBA.

## **Cost-Benefit Analysis of Luas**

The Cost-Benefit ratio of the project at the time of the initial calculations was 1:1.76. In monetary terms this meant that for the £220m investment, the benefits are equal to a monetary value of £387m. By this analysis, conducted by Semaly Ewbank on behalf of the DTI, the benefits far outweigh the costs. Even a 70% increase in costs would still maintain an overall benefit. For any project to rise 70% in costs, either the cost projections were flawed in the first place or the economy is entirely unstable. The first explanation seems most likely here. Eoin Keegan of the Dublin planning office put this point forward by highlighting that most capital intensive projects in Ireland both lower cost prediction to ensure funding and are flawed by not setting rigid targets, which if not met will result in penalising the firm that is delayed. This would ensure the targets are met. The Luas project is now estimated to cost 800m euro (£630m app.), a far cry from the original estimate. This has spiralled the initial CBA estimate upwards, where the cost benefit ratio is now 1:0.35. Therefore if the cost estimates figure was the current 800m-euro figure. Costs outweigh benefits nearly 3 to 1, rendering the project obsolete. To explain why the project should not have gone ahead with these data tables, the DTI report puts it best. "A citywide Dart network with tunnels and underground would cost £600m and as such would be prohibitively expensive. The high cost of the city

cost £600m and as such would be prohibitively expensive. The high cost of the city wide Dart extensions outweigh all quantifiable benefits...such as demonstrated by the results of the CBA undertaken by the DTI'. (DTI Tech Vol6, 1994;34)

Finally due to the fact that Dublin in a low-density city, it is most suitable for buses to serve the mass transit needs. They can reach more people on a wider scale, for less cost than the light rail engineering solutions. Contrary to the DTI report findings, the modal share of Dublin Bus has increased recently (to 21% in 2002) whilst the share of travel by car has decreased slightly to 70%. During this time heavy rail has decreased its patronage with large investment, whilst Dublin Bus has experienced low levels of investment.

### **Alternatives to the Luas project**

When the DTI undertook its study of Dublin public transport, 3 options were studied.

- A comprehensive bus based option.
- An extended citywide DART infrastructure.
- Combined LRT and Quality Bus Corridor Option.

Since then the minister for public enterprise Mary O'Rourke TD has launched the initial process for the development of a Dublin Metro Project phase one.

The comprehensive bus option was turned down because it would not have sufficient capacity to cater for the demand forecasts. It would not relieve city centre congestion. Finally it would not be as successful as either the Dart or Luas in attracting car users or aiding economic regeneration or social cohesion.

The Dart based option in contrast would attract cars and aid economic revitalisation. Journey times would significantly improve citywide accessibility. However this option would be prohibitively expensive and have an extremely long construction period.

The proposed Metro project, which was ignored in the preliminary DTI report, was left out because the benefits of its existence do not outweigh the costs. The costs continue to rise whilst the benefits will not. In fact, across Europe and the USA, public and political support for metro projects are dwindling due to the cost and negative social benefits including crime and safety issues.

## Solution

In my opinion, there is no golden solution to the Dublin congestion crisis. No one service will cure the chronic state of Dublin public transport. In reality a combination of factors only can relieve the pressure put on our city streets. I believe the Luas, although it has become an overly expensive project is a step in the right direction. But by itself will not greatly improve the situation. The Port Tunnel will alleviate many trucks from the city centre and legislation needs to be passed to provide set hours for city centre delivery, so as not to coincide with peak hour traffic. QBC's are a relatively cheap alternative to the Luas. Eoin Keegan stated that bus lanes will be given greater priority in the future. In my opinion continuity is their problem. On the north and south quays in Dublin, they stop and start too often to effectively tackle traffic. If QBC's were given dedicated lanes like the Luas will have, they would be just as efficient, without public work diversions needed. In time if they are not working adequately, it would be possible to change them into tramways.

When planning the Luas, a provision should have been made on their routes, to allow for a segregated bicycle lane. Public opinion in Dublin favours bicycle use (as demonstrated in the DTI Public Consultation Report), if provisions were put in place, making it safe to travel by bike, I believe the lanes would be utilised. This would be achieved at a low cost, whilst also being a healthy option. Congestion charging in the city centre would not be possible now, as no viable transport alternatives are available for the mass transit needs, but when there are alternative modes of transport, London's lead could be followed. In Mannheim Germany, they have an area of integrated transit lanes covering 1km. This is where buses share the tram's segregated track, in effect sharing the cost of the project, thus increasing their benefits for the same cost. This should be done along the Quays in Dublin, to utilise the tram tracks more effectively (LRTA, 1999)

Finally, the Chartered Institute of Transport states that due to the cost of Light rail, "buses will still provide the principal solution to the majority of urban transport needs. Accordingly they need to be assisted through priority measures and integrated with light rail" (CIT, 1991;120). Therefore we should continue implementing schemes to improve bus services such as QBC's and priority traffic light systems, to enable the mass public to avail of a efficient and rapid transport system.

## Conclusion

In conclusion, the Luas has evidently gone over budget and outside the CBA ratio. This deemed the project unworthy of the investment it received and as such a failure. The main reason why the project was delayed and went over budget, was because the original plan literally only stated where the tracks would be laid. Inexperienced contractors undertook this project, with the wool over their eyes, hence they met difficulties as they were operating on a 'trial and error' basis. Both Manchester and Sheffield can be regarded as pioneers and despite hiccups in the early stages are now very successful. Planned new systems can now be spared from going through that expensive learning curve thus bringing down the cost of light rail (LRTA 09/2000). Lines A, B and C in Dublin represent our Manchester and Sheffield experience. Therefore new light rail lines, if constructed, will inevitably cost less than the first 3 sections. I believe the biggest problem we could have, is that we neglect further investment in order to avoid a similar failure. We must begin a new project sooner rather than later but make sure we keep a watchful eye on the CBA.

The main use of this project is that it is a valuable learning lesson for Irish planning. By 2016, vast improvements still can be made but we must consider the cost element of projects more rigorously, The Luas LRT projects still represent sound transport initiatives, this is evident from LRT abroad. I think we must be both more realistic about their cost and time scale to construct. Finally we must point out the overwhelming evidence, which states that opinions on LRT before construction and after, always tend to favour it with the passing of time (Evidence includes the cities of Buffalo and Manchester among others). If this is the case in Dublin, few people will remember the cost element of the project and all will focus on the benefits.

## References

- BARRET, S.**, (1995) *Transport Policy in Ireland* Irish Management Institute.
- BUTTON, K.J AND GILLINGWATER, D.**, (1986) *Future Transport Policy*
- CIE**, (1997) 'Luas Dublin LRT Environmental Impact Statement'
- DUBLIN TRANSPORT INITIATIVE**, (1994) 'Public Consultation'
- DUBLIN TRANSPORTATION INITIATIVE**, (1994) 'LRT Technical Volume 6'
- GEORGI, H.** (1973) *Cost-Benefit Analysis: public investment in Transport*
- HANNON, G** (19/12/02) Consulted as the Manager of Strategic Planning and PR in the Luas office
- IRISH INDEPENDENT**, (27/11/20) 'Property Supplement'
- JOHANSSON, P.O.**, (1997) *An introduction to modern welfare economics*

- KEEGAN, E.** (2003) Presentation to Transport Economics Students on Dublin Planning
- LRTA,** (2000) 'Light Rail, How real problems were the problems' Fact Sheet 106
- LRTA,** (2001) 'Buses-'Stepping Stones' towards Light Rail' Fact Sheet 116
- LRTA,** (1999) 'Light Rail-Pricing itself beyond cost effectiveness' Fact Sheet 74
- LRTA,** (1997) 'Light Rail: successes despite serious opposition' Fact Sheet 56
- LRTA,** (2001) 'Local Travel-Getting the price right' Fact Sheet 121
- LRTA,** (1999) 'Integrated Transit Lanes-A sharing of costs' Fact Sheet 86
- LRTA,** (1999) 'A Detailed Look at LRT' Fact Sheet 73
- LRTA,** (1998) 'Short-term disruptions leading to long-term benefits' Fact Sheet 62
- LRTA,** (1999) 'LRT-A potential success story or a political embarrassment'
- LRTA,** (2001) 'Light Rail-'A logical option but not always the cheapest'
- Powell, M.,** (1997) Light Rail and Guided Transit
- RAIL PROCUREMENT AGENCY,** (1997-2003) 'Newsletters'
- SUNDAY BUSINESS POST,** (16/09/2001)
- THE IRISH TIMES,** (29/11/2002) 'Home news'
- THE IRISH TIMES,** (2/11/2002) 'Business and Finance'
- THE SUNDAY TRIBUNE,** (8/12/2002) 'Commercial Finance'
- Luas (2002) 'Information Pack'

### **Online References**

- Luas web-site consulted (15/12/2002) <http://www.luas.ie>
- Dart homepage available at [www.irishrail.ie](http://www.irishrail.ie) Consulted: (12/01/2003)
- DEPARTMENT OF TRANSPORT** web-site <http://www.transport.ie> Consulted: (15/12/2002)
- DUBLIN TRANSPORTATION OFFICE** Web-site <http://www.dto.ie> Consulted: (15/12/2002)