Designing New Performance-Based Incentive Regimes for Operating Contracts in the Province of Gipuzkoa, Spain

by

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ABSTRACT

Over the last several decades, local transport authorities in Europe and around the world have introduced competitive bidding in concessions for providing bus service, often resulting in reduced costs for service. The main caveat to this approach is that without proper oversight by the authority, operators may reduce quality to cut costs and maximize profits. To counter this, performance regimes are developed and incentives are typically offered to achieve the policy goals of the authority. Through an analysis of current theory and practice, this thesis is intended to serve as an introduction to the end-to-end process of transport contracts– drawing from the fields of contract economics, organizational structure, service quality, and performance measurement as they relate to public transport service.

Expanding on current practice, suggestions are offered for future interurban bus operations contracts in the Province of Gipuzkoa, Spain. First, several recommendations regarding contract structure and bidding procedures are discussed, proposed, and demonstrated. Then, under the framework of the European standard on quality management in public transport, a selection of performance measures are proposed. These measures were especially selected and designed for the technological capacities and operational conditions of Gipuzkoa. Several of these measures (ridership, on-time performance, and completed service) are then suggested for incentives within future contracts. Representative incentive levels and methods for calculating and paying each are proposed for an upcoming contract currently under consideration in Gipuzkoa.

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1 Introduction and Background

This thesis proposes an end-to-end bidding and performance-measurement regime for the interurban bus services in the province of Gipuzkoa, Spain through a critical evaluation of state-of-the-practice contract management procedures currently deployed within the EU. The desired result is to both improve efficiency and build institutional capacity through a combination of a well-defined bidding structure and improved performance measurement, all the while making use of state-of-the-art technology.

After a review of literature, best-practices and selected case-studies, a bidding structure is defined. This comprises several steps, beginning with the definition of a cost model for pricing both a specified level of service and small changes in service. Then, a series of performance metrics germane to the situation in Gipuzkoa are suggested. The proposed cost model is then extended into the beginnings of a basis for payment in new operations contracts. Within the concession itself there are several important dynamic modifications to payments, designed to provide incentives for the operators to undertake actions leading to service quality improvements. These incentives will be calculated using a subset of the performance measures defined earlier. While the central objective of this thesis pertains primarily to a specific application in Gipuzkoa, it is intended to be accessible for other local authorities in search of a synthesis of practice at the intersection of contracting and performance measurement.

1.1 Gipuzkoa

Gipuzkoa, a province in Northwest Spain, forms a part of the Autonomous Community of the Basque Country, and is bordered by the other Basque provinces of Biscay and Alava, the Spanish Autonomous Community of Navarre, the French province of *Pyrénées-Atlantiques*, and the bay of Biscay. In 2006, the population of Gipuzkoa was approximately 687,000, a figure that is projected to grow to nearly 710,000 by 2020 (Basque Statistics Office n.d.). The provincial level government is known as *la Diputación Foral de Gipuzkoa* (DFG). Gipuzkoa is further divided into 9 counties (*comarcas),* each of which has a nucleus in a principal town.

The provincial capital, Donostia-San Sebastián, has a population greater than 180,000 and constitutes the origin or destination for the greatest proportion of trips within the province. There are five other towns with a population greater than 20,000– Irún, Errenteria, Eibar, Zarautz, and Arrasate-Mondragón. Most passenger trips in the province occur either within the counties or between the counties and Donostia- San Sebastián[1], as well as between Donostia-San Sebastián and the neighboring provincial capital of Bilbao.

1.2 Public Transport within Gipuzkoa

Public passenger transport in Gipuzkoa includes a variety of modes and is provided by a number of operators. Several cities and towns also provide urban bus service within their community and surroundings, the largest being dBus, which provides urban service within Donostia- San Sebastián. Interurban bus services are provided by multiple operators throughout the province. Most of these operators[2] are united under the Lurraldebus brand. These services carried nearly 21.3 million passengers in 2009 (slightly over 67,800 per median weekday), up from 18.2 million (approximately 58,600 per median weekday) in 2008.

In addition to bus service, two regional rail services cross the province: the Iberian gauge network of RENFE, which provides commuter rail service from Oñate in the southwest to Irún on the French border; and the meter-gauge network of EuskoTren, which provides service in the northern area of the province, originating in Bilbao in the neighboring province of Biscay, entering Gipuzkoa at Eibar in the west and continuing east along the coast, through Irún and terminating across the border at Hendaye in France. Both rail networks serve Donostia-San Sebastián. This work

1 A total of 48% of trips on the Lurraldebus network begin or end in Donostia. For further information on passenger trip distribution within Gipuzkoa, see Gomez Gelvez (2010).

2 The LOTT (*Ley de Ordenación de los Transportes Terrestres*, the primary regulation which governs land-based transport in Spain) specifies that interurban services between autonomous communities are under the control of the Spanish Ministry of Development, while the interurban services wholly within autonomous communities are designated by the competent local authority within the respective autonomous community (Comisión Nacional de la Competencia 2008). It is primarily for this reason that not all interurban routes that travel within Gipuzkoa are under the Lurraldebus brand. For further information on the LOTT, see section 2.3.1.

focuses solely on the contractual interactions between the province, as manager of Lurraldebus SL and the operators that provide interurban bus service under the Lurraldebus brand. That being said, the fluid nature of bus service combined with a properly-designed, flexible contract for interurban bus service can aid in coordination across modes by allowing for targeted small changes to service, specifically network characteristics geared towards synchronization.

1.3 The Birth of Lurraldebus

Prior to mid-2007, the interurban buses of the province of Gipuzkoa were privately operated. Bus routes were packaged into concessions and awarded based largely upon historical precedent and allowing the local incumbent operators to retain their operating rights. While the province provided a subsidy for fleet renewal[3] existed, neither fares nor direct operations were subsidized and the DFG had little information to regulate the operators. These services were not highly regarded, and the automobile was making consistent gains in mode share. As a result, the number of interurban bus trips declined 25% in the decade between 1996-2005 (Diputación Foral de Gipuzkoa 2008, 2).

To reverse this decline, in 2003 the province began studying methods to stimulate the demand for trips taken via interurban bus. The first major act of this effort was enacted on 28 December 2004, with the goals of stimulating improvement in passenger transport, the Gipuzkoa Provincial Council authorized the creation of agreements with various communities (*mancomunidades*) and counties in order to finance "sustainable mobility plans." These plans focus on near- and medium-term results to prioritize both improved mobility for the population and sustainability, with the goal of facilitating additional trips on public transport for those who live, work, or study within the same county. The first county to enact one of these plans was the Alto Deba, where the seat of major activity is the industrial and university town of Arrasate-Mondragón.

3 The subsidy provides for 50% of the purchase price of a new bus. The main goal of this subsidization regime is to maintain a maximum vehicle age of 12 years, and a fleet average age of 6 years. Through this program, the DFG has subsidized 78 new buses between the years of 2003-2010 (El Diario Vasco 2010). This represents approximately 25% of the Lurraldebus fleet.

After this policy was devised, the province and the towns of the Alto Deba realized that it was necessary to redesign the bus passenger service throughout the area, focusing specifically on improving service frequencies. These schedule changes were approved by provincial order on 22 August 2006. The implementation of new service resulted in a large increase in net cost, projected at €1.4 million for the first year of operation. Increases in fare revenue were not projected to offset these costs. As a result, on 12 September 2006, the provincial council approved the necessary measures to fund the new services offered by the concessionaire through the means of an operating subsidy. These services were put into effect that month.

After the inauguration of these new subsidies, the province, being the regulator of regular bus public transport has worked towards a series of measures to guarantee mobility within the entire territory and make public transport more attractive in relation to the private automobile for all of the services under its control. In addition, steps needed to be taken to improve the image of public transport. On 22 November 2005, the formation of Lurraldebus SL was approved by the provincial council. The Lurraldebus brand united all of the operators and services under provincial concession. The primary results of this initial effort were the development of the Billete Único (common ticket), a smart card used as a method of payment across all operators, and the re-branding of all services provided by operators who were signatories to the original effort. Underlying the Billete Único is an integrated fare collection and Automatic Vehicle Location (AVL) system, which was implemented by consultants involved in the project and coincidentally, provides a wealth of data for analysis.

On 15 May, 2007, the provincial council approved the authorization and funding for the deployment of the Billete Único for all concessions under provincial control. These included the setting of a timetable for implementation, the creation of a zonal fare structure with price discounts that increased with usage (Figure 1.1), and the creation of an annually revisable payment system designed to maintain the "economic equilibrium" of the concessions. In order to reach an agreement with the operators, the concession contracts for existing routes were rewritten to guarantee that if the concessionaires maintained the same level of service, their total revenue, from a combination of fares and subsidy, would not be less than a specific agreed-upon total revenue. Fares collected were returned to the operators, and subsidies were added, if needed, to this total in order to meet the agreed-upon revenue. These payments did not include any relation to the quality of service provided. Furthermore, the process of increasing offered level of service was not clearly defined.

FARE / ZONES TRAVELLED	0	I	I A-8	2	3	4	L.R. (1)
Reference Fare	1,15€	1,70€	1,85€	3,40€	5,25€	6,90€	9,40€
1 to 40 trips per month -40%	0,69€	1,02€	1,11€	2,04€	3,15€	4,14€	5,64€
41 to 70 trips per month -70%	0,35€	0,51€	0,56€	1,02€	1,58€	2,07€	2,82€
More than 71 trips per month -90%	0,12€	0,17€	0,19€	0,34€	0,53€	0,69€	0,94€
Night or Special	1,60€	2,65€	2,80€	4,50€	6,50€	8,00€	12,00€
Cash Payment	1,30€	1,85€	2,10€	3,70€	5,80€	7,35€	9,65€

(1) L.R. Long Trip

Figure 1.1: Lurraldebus zonal fare table

As a result of the fare-policy changes introduced in the past several years, the system designed for the management of and payment for the services covered under concessions remains very complex. The most difficult problem arising from the situation relates to the modification in levels of service for each operator. Thus, it is necessary to establish procedures with respect to the interaction and integration of individual bus routes and the multi-modal system as a whole, with the goal of easier facilitation of the administration's planning, operation and control of the services.

Realizing this, the DFG has modified the contract for the public transport services operated by the concessionaire Trasportes PESA, SA. As the system of passenger fare discounts has unpredictably changed the structure and amount of revenue collected on a route-by-route basis, this modification moves the basis of payment from a guaranteed income to that of an audited per-kilometer cost. To aid in the modification of service, the amount of service-km may be modified by ±12% without re-negotiation. To further encourage the operator to maintain the service quality to the benefit of passengers, an additional 7% of collected revenues is offered to the operator to provide for a reasonable profit. This contract is viewed as a test case for future concessions, which gradually will be put out to bid starting in 2012.

1.4 Objectives and Research Approach

The motivation for this research is the expiration of the current round of concessions in 2012. The DFG considers the Lurraldebus project to be a success, with substantial gains in the number of passenger trips being provided and taken on interurban public transportation-- increasing from nearly 15.4 million in 2005 to nearly 17.2 million in 2008 (Diputación Foral de Gipuzkoa 2008, 2). Furthermore, the Billete Único smart card is the method of payment used for nearly 70% of trips taken on the Lurraldebus network. This success, however, prompts new questions and the current situation leaves room for improvement in the contracting scheme. Given that the Lurraldebus project and the contract modifications that accompany it were proposed and rolled out in a short period of time, this did not allow for an in-depth analysis of the goals beyond incremental ridership gains which the new regime was to accomplish.

Some of these goals are now clear. Re-organized concessions present an opportunity for increasing efficiency through economies of scale and density. Further efficiency can be gained by using automated scheduling software to create schedules that both maximize efficiency for vehicles and provide more information to passengers. This process can make use of the data warehoused within the Lurraldebus information system.

Furthermore, before the next round of concessions are put up for bid, Gipuzkoa's Minister of Transport has expressed interest in the next round of contracts including a performance bonus given the attainment of certain criteria. This thesis seeks to select appropriate criteria and present methods for developing performance targets for the operators based upon both current operating data and policy objectives defined by the DFG administration.

Chapter 2 begins with a foundation from a wide variety of literature that will serve as technical background for the rest of the thesis– specifically brief introductions to contract economics, cost modeling, bidding procedures, and performance measurement. Chapter 3 then continues with several case studies of contract and incentive structure in other European regions, utilizing the concepts introduced in Chapter 2 for analysis of previous and current practice.

Chapter 4 focuses on the design the contract bid framework and overall bidding process, taking special consideration of the relevant circumstances in Gipuzkoa. This focuses primarily on the Donostialdea-Este area, proposed to be the first concession to be bid after the introduction of the Lurraldebus project. This includes a reorganization of the existing concessions, as well as the inclusion of increased information in the bid package – primarily the inclusion of vehicle schedules and information on operational conditions and performance for the routes involved. The process will make use of Lurraldebus AVL and fare data, and will take into account variations in operating conditions. Before the final bidding procedure can be introduced, several important aspects of a contract regime are covered. The chapter concludes with an improved cost model to guide the estimation of costs incurred in providing service or changes in service.

Chapter 5 defines the measures included within the proposed performance regime. The performance measurement regime is comprised of various measures covering a variety of quality aspects and focusing on the performance of the entire Lurraldebus network. Finally, the chapter concludes with recommendations on how to continuously monitor the performance of the operators within the Lurraldebus network.

Chapter 6 discusses a subset of these indicators previously proposed and their use as incentives tied to the value of the contract. Examples, both real and theoretical, are given to show the reader how these incentives would modify the contract value.

Chapter 7 presents the conclusion of this thesis, beginning with a summary of the topics covered therein and the final recommendations. It concludes with some of the opportunities for future research that arose during the research process.

2 Review of Literature and State of the Practice

This thesis draws upon a wide variety of work in the fields of contract economics, transport contract design, quality management, and performance measurement in public transport in order to understand the state of the practice in transport quality. In order to further discuss a proposed contract and performance regime for Gipuzkoa, a non-exhaustive introduction to each of these fields and the interrelationships between them is presented. For further information, it is suggested that the reader refer to the works cited.

2.1 Contract Economics

Halvorsen (1993) examined the relevance of the theory of contract economics in the transport context and surveyed public transport authorities within the US to determine their usage of various contracting forms. The development of the field of contract economics has been driven by the need to understand the implications of the relationships between a principal (the party who authorizes the actions of another party) and an agent (the party who will act given the will of the principal). Elements that may concern the public transport provisioning are the study of development of a workable contract to entice the entrance of agents into a field, and to then entice these agents to perform in accordance with the wishes of the principal.

Frequently, it is assumed that two parties entering into an agreement have complete information about the factors relevant to the choices they make. This is often not the case, as the seller of a product (or in the transport context, the incumbent in an area) often knows more than the buyer. This phenomenon is referred to as asymmetric information (Pindyck and Rubinfeld 2001, 595). Literature on contract economics defines two large problems under the topic of asymmetric information; adverse selection-- the influence of asymmetric information on entering into a contract with another party-- and moral hazard-- where both parties enter into an agreement with equal information and eventually one fails to provide the information to the other. This causes the parties to behave differently than they would otherwise. Adverse selection can arise when an operator, who is most aware of a deficiency within the contract specification and most aggressively pursues extra compensation for changes, can be awarded the contract (Hensher and Wallis 2005). Moral hazard has also become an acknowledged problem in some transport market failures, such as the spectacular contracting meltdown in Melbourne, where an overly optimistic contracting and finance scheme led to predictions for revenue growth that did not materialize. As a result, the operators involved provided gradually degraded service and could not be held accountable by the local authority (Mees 2005; Blakey 2006).

Contract economics, as considered by Halvorsen, makes two assumptions about the environment in which parties enter into a contract. First, there is only one principle who offers the contract and that there are multiple bidders competing to win the contract. The principle must construct contracts that will interest a number of potential agents in the contract. The second assumption is that the principle understands the agent's objectives and cost and utility functions. If not, the contractor may determine a manner to achieve the stated objectives while negatively affecting the principle's utility.

Halvorsen notes two different schools of thought regarding contract development. Within the transportation literature, contract incentives are a method designed to steer the agent's behavior by providing incentives for the agent to attain certain standards. The process involves selection of quantities, gathering of indicators, and then the development of a payment function based upon the performance shown by these indicators, synthesized into the bid and contract documents. Information on the structuring of performance regimes is described further in section 2.4.

The other school of thought was the application of the theory of contract economics in transport contracting. Theoretically optimal contract economics requires the simultaneous consideration of four inter-related factors:

1. The objectives of the principal, such as quality service;
2. The objectives of the agent, such as profit and reputation;

3. The agent's cost of actions, such as incentive attainment; and
4. The parties' understanding of how the outcome can be verified.

By simultaneously considering these four factors, both the principal's net benefit can be increased and the resources used in the monitoring of the contractor's performance can be reduced.

Given the current realities of public passenger transport in the US and Western Europe--conflicting objectives of providing high quality service at minimal cost, while requiring a subsidy--simultaneously solving a system of equations based upon the above four factors is difficult, if not nearly impossible. Nevertheless, a crucial component of this is a utility function, which weighs the priorities of service quality and cost together, for the agency. If an agency is able to specify the acceptable ratio of quality to cost, the contracting process will be much easier to reconcile. Without understanding the objectives of both parties, agencies are at a disadvantage.

After estimating the objectives of contractors, the agency must then estimate the costs of obtaining these objectives. All work performed by a contractor involves costs, both direct and indirect. Without incentives or penalties, contractors will tend to optimize the service provided in a manner that minimizes net cost or maximizes net gain. In simple theoretical fixed price contracts, this can result in operators lowering service quality to a bare minimum, while in pure cost-plus contracts this may result in a desire to increase costs and thus profit.

Similar to the agency's dilemma, not all contractors will have clear utility functions, as objectives such as maximizing profitability while maximizing reputation may be somewhat exclusive. Additional complications arise due to the fact that contractors have a greater set of options in their operations under contract. Modeling the diversity of these options and obtaining the proper inputs given asymmetric information, Halvorsen notes, "would be a computational nightmare" (Halvorsen 1993, 50).

The difficulty in computing true utility functions aside, a great deal can be gleaned from the study of contract economics. First, the maximum benefit from contracting is achieved when there are many participants willing to bid for a contract. Benefits from contracting are extracted from competition; a smaller number of bidders results in the authority's loss of power to determine the terms of the contract and hence the benefits of competition. Furthermore, the agency, when bidding new contracts, should have in mind the objectives-- both financial and reputational-- and costs of the potential contractors. Laffont and Tirole (1986) point out that with a greater degree of asymmetric information, the agency pays higher costs for lower quality. As stated above, with increased risk-- be it in the form of a large penalties or uncertainty-- the price of contract bids increase. Optimal contracts will involve the agency bearing more risk as the contract becomes more risky.

2.2 Transport Contract Design

Service contracts can be divided into two general forms, cost-plus and fixed-price. Cost-plus contracts specify an amount (which can be either fixed or a variable percentage of costs) above the contractor's cost to be added onto the contract in the form of profit for the contractor, while fixed-price contracts have the contractor initially define the cost of the service, including their expected profit, and are free to allocate their own costs.

In theory, pure cost-plus contracts provide no direct financial incentive for the operator to lower costs. In practice, however, transport contracts usually have a "ceiling," or an upper cost limit; they are not easily amended without re-negotiation and thus the incentive to control costs remains. In any case, monitoring contractor costs needs to be an integral part of a contractual arrangement for all cost-plus contracts. The theoretical inefficiencies of cost-plus contracting in public transport were confirmed empirically by Roy and Yvrande-Billon (2007) who found that over a large multi-year panel, French operators under cost-plus contracts exhibited greater levels of inefficiency than operators under fixed-price agreements.

In addition, Halvorsen found two further factors that may have the tendency to reduce a contractor's cost in cost-plus contracts: competition in the bid process (assuming the selection criteria is based at least in part upon the bid price), and possibility of a damaged reputation for the contractor if they exceed the estimated contract total by a significant amount.

Pure fixed-price contracts provide the contractor with a great incentive to minimize costs. While this may be seen as an advantage over cost-plus contracts, it can be a detriment as well. There is no direct incentive in the most basic fixed-price contract to provide quality service; without performance regimes, fixed-price contracts can compel the contractor to drive costs down, often having negative effects on service quality.

It is for this reason that performance measurement is commonly included in the contract terms for privatized public transport provision. The implementation of these standards tends to increase both service quality and cost. In order to maintain and stimulate quality results in accordance with the measures integrated into the contracts, penalties and incentives are usually applied to the contract terms. Operators will tend to concentrate on achieving them, often at the expense of other performance factors not specified in the contract. Further information on incentives in Transport contracts can be found in section 2.4.4.

2.3 Transport Organization Regimes and Tendering

A variety of organizational forms exist for public passenger transport. In the mid-1990s, with the entrance of new member states into the European Union, research was conducted on organizational a framework was developed to organize the process-- the Strategic, Tactical and Operational framework (otherwise known as STO) (Macario 2001; van de Velde 1999)-- treats policy, planning and operations as three different levels:

1. The Strategic level asks the fundamental question "what do we want to achieve?" The organization in charge at this level should also provide guidance on achieving said goals. This role is often filled by a ministry of transport;
2. The Tactical level, where the translation of the political goals to the product specification-- specifically fare and service policy-- is undertaken. This role can be filled either by a local transportation agency, an outside consultant acting under the authority of the ministry of transport, or the operator themselves; and
3. The Operational level, which is purely concerned with delivering the service defined according to the strategic and tactical levels. The operational level can further be divided into what Van de Velde refers to as "hardware," that which produces the service-km, and "software," (such as marketing and passenger information) that helps *sell* service-km and transform them into passenger-km. The hardware and software may be provided by different

organizations.

In practice, a multitude of forms of organizational relationships exist between principals and agents[1]. Two super-types of these relationships are the market initiative regime and the authority initiative regime.

Under a market initiative regime, commercially viable services are expected to be created by market processes. The purest form of this regime is an open entry regime, where there are few or no barriers to entry and operators "compete in the street" for passengers. Pure open entry regimes are optimal only in the absence of market failures. In the case of market failures, the regime can only reach a second-best equilibrium[2], although this may be considered acceptable if the costs of regulation are higher than the benefits. Possibly the most recognized and studied example of this regime is the British Bus deregulation of the 1980s (Rye and Wilson 2002). A more common arrangement under a market initiative regime is an authorization regime, where the market is still tasked with creating service, but operators have to receive the authorization of the market regulator before entry.

Authority initiative regimes, on the other hand, are common where it is believed that markets cannot create profitable services. At its most pure, authority initiative regimes involve public management and operation of transport service. This is common within the US and some regions of Europe. More common in Europe, however, is competitive tendering (CT) for the operation[3] of a network or parts of a network.

The rationale behind tendering public transport is often seen as a triumph of the power of free markets. Through the competitive process, it is believed, CT results in the provision of services

1 A number of examples of these forms as practiced throughout the EU are discussed in Inno-V et al. (2008)

2 A second-best equilibrium is when "one accepts that certain direct measures are not feasible for political reasons or could not work because of practical objections. For this reason, one falls back on measures that are not 'first choice' for realizing a general optimum, such as indirect intervention in the transport sector." While not as efficient as a theoretical first-best solution, a second-best optimum has the advantage of political feasibility (Blauwens, Baere, and Voorde 2008, 374).

3 Some areas, such as the Netherlands, have tendered responsibilities at the tactical level. For more information on see van de Velde, Veeneman, and Schipholt (2008)

more responsive to public needs. The profit motive presumably drives operating costs and fares lower than under public operation, and demand will increase and be adequately provided for (Karlaftis 2008). There has been some evidence that this is generally the case. In 2001, a European Commission survey found that cities using controlled competition in public transport experienced a 1.8% increase in the annual rate of change in passenger journeys, while cities without competition logged a 0.7% decrease (Colin Buchanan and Partners 2001, 2-4). While ridership has been shown to increase under CT, a consistent decrease in subsidies are not necessarily the case. After an initial tender, subsidies in tendered services can decrease in the range of 20-30%, yet subsequent tenders deliver minimal gains in subsidy reduction. Often, these re-tenders show cost increases at levels greater than the consumer price index, in part a response to the initial winner's curse (Hensher and Wallis 2005).

2.3.1 The Regulatory Framework within the European Union and Spain

Within Spain, interurban land transport is regulated under a framework specified by national law (the *Ley de Ordenación de los Transportes Terrestres*, or LOTT). The LOTT specifies that the operation of any over-the-road passenger transport services within Spain, the operator must be licensed and hold a title or concession to the routes serviced. The most common application of these regulations is the assignment of interurban bus routes to operators by tender and concession-- meaning that operators compete "for the market," and after winning a concession have the sole right to operate services along a route or package of routes. Concessions under the LOTT have a length of six to fifteen years, while established practice reflects durations between eight and twelve years. Furthermore, the LOTT allows for the duration of a contract to be extended, allowing some flexibility (Comisión Nacional de la Competencia 2008).

At the level of the European Union, Regulation No 1370/2007 defines how "competent authorities may act in the field of public passenger transport to guarantee the provision of services of general interest which are among other things more numerous, safer, of a higher quality or provided at lower cost than those that market forces alone would have allowed" (Anon. 2007, 6). The method for this provision of services through concession[4] is the Public Service Obligation (PSO); regulation 1370/2007 is commonly referred in the literature to as the Public Service Obligation Regulation, or PSOR. In several areas, the PSOR supersedes the regulations of the LOTT, such as the stipulation of a maximum contract duration for PSO contracts of ten years for bus passenger transport. Within these ten years, contracts may be extended by a maximum of half their initial duration – i.e. a six year contract may include the option of a three year extension.

Some of the many aspects of the PSOR are the requirements to establish in advance the following points with regards to bonuses:

1. The parameters (including incentives) on the basis of which the compensation payment, if any, is to be calculated;
2. The nature and extent of any exclusive rights granted, in a way that prevents overcompensation;
3. A specification the arrangements for the allocation of costs connected with the provision of services; and
4. To ensure that no compensation payment exceeds the amount required to cover the costs in providing the Public Service Obligations, taking account of revenue kept by the public service operator and a reasonable profit. (Anon. 2007, 7)

Throughout the duration of a contract, these four points are to be addressed yearly by the authority in an aggregated report on the public service obligations that it is responsible for, including the selected public service operators, the compensation payments and the exclusive rights granted to the public service operators by means of reimbursement (Inno-V et al. 2008a, 80).

As the PSOR oversees the procurement of public transport contracts, all contracts and tenders must follow its guidelines. It serves as the underpinning for the proposed contract structure introduced in Chapter 4.

4 "A concession, as defined by the Public Procurement Directives, being a contract where the consideration for the provision of services consists either solely in the right to exploit the service or in this right together with payment." (Inno-V et al. 2008a, 92) If an operator is to take some portion of revenue risk that agreement is defined as a concession and not as a procured service.

2.4 Quality and Performance Management

Osborne and Gaebler (1992) discuss instances where government can function as efficiently and productively as private business. Moving from seeking and funding inputs or outputs to outcomes, they argue, has improved government performance at various levels; instead of defining arbitrary goals and funding amounts, efficient governments would define goals, various levels of indicators and objectives. Furthermore, measurement should focus on results and effectiveness, not the process and efficiency. While process and efficiency may be easier to measure, they are only indications of a small part of overall policy. Building on this work, Osborne and Gaebler defined six important points that show the power and motivation of performance measurement.

- If you do not measure results, you cannot tell success from failure.
- If you cannot see success, you cannot reward it.
- If you cannot see success, you cannot learn from it.
- If you cannot reward success, you are probably rewarding failure.
- If you cannot recognize failure, you cannot correct it.
- If you can demonstrate results, you can win public support. (Osborne and Gaebler 1992, 143-155)

These six points provide an introduction to results-based monitoring and evaluation in the quality literature and serve to guide the following sections.

What follows is a brief and non-exhaustive overview of quality management both in general and within the transport context, structured using the points above. For further information on general theories of quality, see Kusek and Rist (2004). For further references on quality management specific to transport, refer to MAX Consortium (2007) or Vincent (2002).

2.4.1 Measuring Results In Public Transport

The International Standards Organization (ISO) defines several renowned quality standards. The ISO 9002 Standard, developed in the late 1980s and later rewritten in 1994, served as a "model for quality assurance in production, installation, and servicing." Its major focus was to avoid product defects introduced in manufacturing. ISO9004 further emphasized "Total Quality Management"

(TQM), a process for satisfying the expectations of customers while increasing productivity and competitiveness, generally in the management process.

Both ISO 9002 and 9004 were integrated into and superseded by ISO 9001. Quality management, according to ISO 9001, is an integrated system centered around the concept that each organization shall define a quality system for its own necessities. This system is based upon a framework of certain principles which an organization is to base their quality management processes on. These principles are:

- Customer focus
- Leadership
- Involvement of people
- Process approach
- System approach to management
- Continual improvement
- Factual approach to decision making
- Mutually beneficial supplier relationships (ISO)

While these principles are laudable, they apply most directly to organizations producing tangible products and focus on production quality, not output quality-- in other words they represent the ideology that "if the hens are well cared for, they will lay good eggs." In transport, this often turns out not to be the case, as the firm's view of quality and the customer's view of quality are often very different.

A key difference between the transportation industry and other industries is that the service must be produced at the moment it is needed and cannot be warehoused – providing exceptional service overnight or in the early morning is not useful to passengers traveling during the peak hour. An example of this need to remain customer focus is as follows: if a transport organization specifies the availability of an escalator in hours, the number of customers this affects will depend on the hour in which the downtime occurs. Downtime or poor performance at peak hour will impact more customers negatively than downtime at off-peak hours. The ISO's production-focused quality model does not acknowledge either of these factors. (Liekendael 2006).

TCRP 8 (1995) set out to introduce TQM principles to the transit world. It introduced TQM as

> "a comprehensive and long-term transformational process. As a result of this process, an organization moves from a traditional, outdated mode of operating to a newer, more progressive way of running the enterprise. Along the way, the organization learns how to change, improve, and evolve continuously. It does this by focusing on people first – in particular, on passengers, employees, and people in the community. Systems, procedures, structure, measures, and responsibilities are transformed to support the employee's desire to serve the passenger and the community (MacDorman 1995)."

The principles it focused on were largely organizational, dealing with customer and labor relations and effective management. While quality measurement was discussed, it proposed neither a usable framework for performance measurement of delivered service, nor an analysis of the relationship between service quality and customer satisfaction. While both the TQM procedures discussed in TCRP 8 and in the ISO quality frameworks are important to consider in the provision of passenger transport, the discussions do not provide sufficient methods for the creation of results-based performance regimes.

2.4.2 Seeing Success: Selecting Performance Measures

TCRP 88 (Kittleson & Associates 2003a) focused specifically on designing transit performance-measurement systems. It described three reasons why performance is measured by transport agencies:

1. Because they are required to do so;
2. Because it is useful to the agency to do so; and
3. Because others outside the agency need to know what is going on.(Kittleson & Associates 2003a, 4)

The report then considers four distinct points of view from which performance can be measured: customer, community, agency and vehicle/driver. Each point has different criteria for what is important and vital regarding the performance and delivery of service. The framework presented for contemplating the four points of view were then conceptually arranged linearly, as is seen in Figure

2.1. Designing an effective performance-measurement regime must both measure and satisfy all of these points of view.

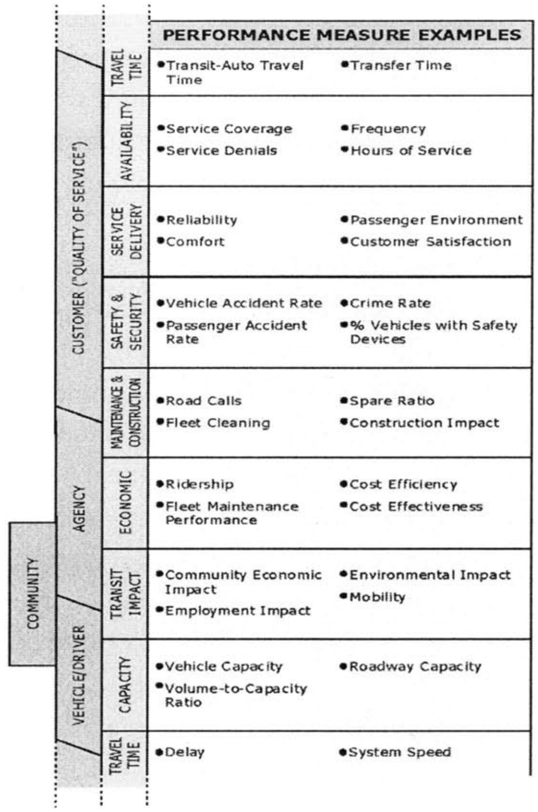

Figure 2.1, TCRP 88: Transit performance measure points of view, categories, and examples

The steps defined in TCRP 88 for developing a performance-measurement program follow.

1. **Define goals and objectives.** An agency's first step should be to define its goals and objectives. If a program is not well integrated with an agency's goals and objectives, the program will be ineffective in performing its core function: measuring the system's ability to achieve its goals and objectives.
2. **Generate management support.** Once the overall goals and objectives have been determined, those objectives should be supported by agency management. A performance-measurement regime is not effective without the ability to take corrective action. If management has not "bought in" to the objectives, this is unlikely to happen smoothly. Important factors in earning management support are providing easily understood aggregate measures that can be repeated at regular intervals.
3. **Identify internal users, stakeholders, and constraints.** It is crucial to determine who will be using the performance-measurement program on a regular and periodic basis.

Furthermore, the level of detail in the resulting measures will be heavily influenced by the technical and financial resources available to the agency.

4. **Select performance measures and develop consensus.** In order to meet the objectives specified, performance-measurement categories are selected. A review performance measures used in similar circumstances should be undertaken. Data collection constraints, as identified in step 3 are taken into account as performance measures are selected. Targets or standards for the selected measures are set in accordance with the objectives. Building consensus among the key stakeholders involved on what aspects to measure and also how to measure is also crucial.
5. **Test and implement the program.** A pilot is conducted to test the agency's data collection and analysis capabilities. If issues arise, alternative measures or targets can be developed. Program responsibilities are assigned to area staff, and the program is implemented.
6. **Monitor and report performance;** As the program is implemented, a schedule for regular performance reporting is created. System performance is monitored according to that schedule. Results are verified for reasonableness and integrated into a report format.
7. **Integrate results into agency decision-making.** After the results are available, develop a preferred approach for improving certain measures. Compare the performance results with the goals set for each measure; for measures not meeting their goals, identify action items for improving performance. For measures consistently exceeding their goals, consider increasing the target, if cost-effective to do so.
8. **Review and update the program.** (Kittleson & Associates 2003a, 68-97)

On a similar, yet slightly different track, the European Union funded the QUATTRO program (1996 – 1998) in order to further focus on the distinctive nature of public passenger transport with regards to both the organizational and customer perspective. QUATTRO was tasked with developing and improving "quality in urban public transport tendering, contracting, and monitoring procedures," and asked two fundamental questions. First, how is service quality defined in public transport? Second, how can quality concepts be included in public tendering and contracting to improve service provided?

QUATTRO identified four types of quality in Public Transport-- expected, targeted, delivered and perceived. The definitions from the report follow.

- **Expected Quality:** This is the level of quality anticipated by the customer and it can be defined in terms of explicit and implicit expectations. The level of quality expected by the passenger can be defined as the sum of a number of weighted quality criteria. Qualitative and quantitative surveys can be used to identify these criteria and to assess their relative importance. Implicit expectations can also be determined from such studies.

• **Targeted quality:** This is the level of quality that the operator aims to provide to passengers. It is dependent on the level of quality expected by the passengers, external and internal pressures, budgetary constraints and competitors' performance. The targeted service can be defined in terms of the results to be attained by the system rather than in terms of process characteristics. It is made up of an identified service, a level of achievement for that service and a threshold of unacceptable performance.

• **Delivered Quality:** This is the level of quality that is achieved on a day-to-day basis in normal operating conditions. Service disruptions, whether or not they are the fault of the operator, are taken into consideration. The relevant measurements are established using statistical and observation matrices.

• **Perceived Quality:** This is the level of quality perceived by passengers in the course of their journeys. However, the way passengers perceive the service depends on their previous personal experiences with the service or with its associated services, on all the information they receive about the service - not only that provided by the company but also information coming from other sources - their personal environment, etc.; Perceived quality is therefore subject to bias. (OGM s.a. 1998, 63)

In working towards uniting the four types of quality, a "quality circle," developed by Bernard Averous of the RATP in Paris and simplified from the ideas of ISO9004, was adopted by the QUATTRO group (Liekendael 2006). The circle (Figure 2.2) clearly defines the four areas of quality to be measured. Unlike the 4 point-of-view model presented in TCRP 88, the QUATTRO project organizes the four types of quality under two distinct frames for perception-- operator (driver and agency) and customer (passenger). On the right side of the circle, operator perspective is considered and the left side of the circle the passenger expectations are considered.

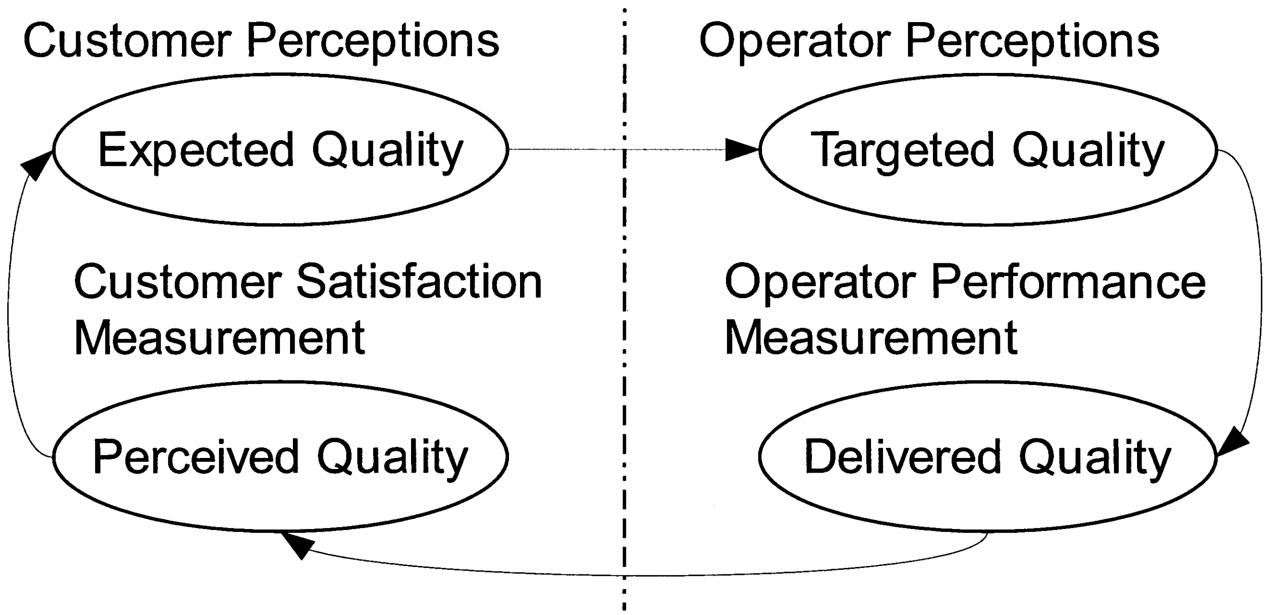

Figure 2.2, QUATTRO Quality Circle.

The four measures of quality integrate multiple perspectives of quality and most importantly demonstrate the relationship between the types of quality. While the perspectives of operators and customers are different, interrelationships exist between the two. In addition, this perspective allows for conceptual measurements of the gaps in service design between each of the four quality areas. The difference between expected quality and delivered quality relates to the quality improvements in areas important to customers that operators are able to influence. The difference between targeted quality and delivered quality can be considered as the representative of the efficiency of the operator's efforts to reach their targets. The difference between quality perceived and quality delivered can be considered as the degree of customer satisfaction.

2.4.3 Learning from Other Successes: Self-assessment and Benchmarking

After understanding quality theory and the relationships between the various types of quality, and yet before an organization can begin a process of continuous improvement, it must undergo a self-assessment-- "taking a hard look at your organization and scoring it against an ideal or model".

This provides several advantages, as promoted by the European Framework for Quality Management (EFQM), including

- A rigorous and structured approach to company improvement programs;
- An assessment based on facts and not on individual perceptions;
- A way to reach a coherent orientation and a consensus on the actions to undertake;
- A way to integrate multiple quality management initiatives to normal company activity;
- A powerful diagnostic tool; and
- Benchmarking possibilities. (EFQM Self Assessment Guidelines, as cited in OGM s.a. 1998, 102)

Common issues that arise in the transport sector during the self-assessment procedure include:

- **Leadership and system coordination:** The allocation of responsibilities between the different bodies involved ("Who does what?") is not always well defined and this can lead to duplications of effort. Questions to address are: "Are the available resources efficiently exploited" and "Do processes exist to manage the total system optimally"
- **Policy and strategy:** Strategy and transport policy are not always coordinated or integrated in time and in space. The importance of PT in mobility policy is not always well understood or well developed. The PT sector does not offer any unified image of the complementary transport modes available to the public[5].
- **People management**: In this respect, one important issue is: "Do the workers of the PT sector receive adequate training and development opportunities?"
- **Customer satisfaction:** Customer satisfaction is mainly measured at the level of the operator, asking questions such as "Does the service provided by the operator fulfill the expectations of the users?", "What about the measurement of their global satisfaction at with the transport system", "What about the expectations of stakeholders, non users and of potential users". (OGM s.a. 1998, 102-103)

A more comprehensive discussion of all of these topics is found in the QUATTRO report. It is in asking these questions critically and reviewing the answers that an organization can begin the process of deciding what measures, or benchmarks are to be used.

A benchmarking regime can be established to ask and answers three fundamental questions: "where are we now?", "Where do we want to go?", and "How do we get there?" On an ongoing basis, benchmarking is intended to promote improvements across an organization by allowing the

5 While the Lurraldebus brand has created a unified image for interurban bus service in Gipuzkoa, other modes, including urban bus and commuter rail remain to be integrated. For more information on the integration process, see Gomez Gelvez (2010).

comparison of performance among that organization's units. In the longer term, it can be integrated in setting strategic goals and identifying methods for their improvement. Benchmarking is commonly described as the systematic comparison of the performance of an organization or department in one of the following two ways.

- Other departments (in the public transport context, commonly this is thought of as other routes or garages within the system). This is commonly referred as internal benchmarking.
- Other organizations in the same field. This is known as external benchmarking. (OGM s.a. 1998, 109)

External benchmarking is becoming more common primarily within large public transport operators. As the organizations that engage in comprehensive external benchmarking are comprised of the world's largest public transport authorities[6], and not smaller authorities, like those of areas such as Gipuzkoa, further references to benchmarking will refer to internal benchmarking.

The principle task in the benchmarking process is the selection and measurement of quality indicators. According to the quality circle, there are two types of measurement to be made; targeted and delivered quality are measured by a combination of "Mystery Shopping Surveys" (MSS) and "Direct Performance Measures" (DPM), while perceived and expected quality are measured using"Customer Satisfaction Surveys" (CSS). Mystery Shoppers are trained teams who objectively measure the passenger experience according to pre-determined criteria, acting as if they were regular customers traveling on the system. Direct Performance Measures are more traditional analysis of operational performance, calculated from surveys and automatically collected data. Finally, Customer Satisfaction Surveys are designed to measure the extent to which a customer believes his/her requirements have been met.

The quality circle, introduced in Section 2.4.2, was further expanded into the European Standard EN 13816. (CEN 2002, 7) EN 13816 was created as a concise framework to implement and operationalize the recommendations of the QUATTRO project. A quality management strategy

6 The CoMET group (Vincent 2002, 51) and the International Bus Benchmarking Group (IBBG) (Randall et al. 2007) are organized to share common information such as key performance indicators among members of the group. The members of IBBG all have over 1000 buses, and there does not appear to be any similar alliance of smaller transport operators/authorities.

is required of service providers, most importantly involving the selection of a set of quality criteria, determination of acceptable levels, measurement, and determination of corrective action to be taken in case of non-compliance. EN 13816 was slightly revised by EN 15140 (2006), which clarified the conceptual framework for the measurement of delivered service quality. Crucial to this was stressing the need to define precisely what is "in conformity." Perhaps most interesting in this update was the admission that "the design of the measurement system shall balance the customers' viewpoint and the use of measurement as a management tool for reaching targeted quality ([the] management viewpoint)" (CEN 2006, 6). Other clarifications noted the power of simplicity. A simple measurement system can be satisfactory if it "leads to on-field operations to maintain and increase customer satisfaction" (CEN 2006, 9).

A quality management system defined according to EN 13816 begins with an overview of existing quality performance and from this, areas with potential for improvement are identified. Targets are set, then a reproducible process of creating quality criteria from data is developed. Quality criteria fall under 8 categories:

1. Availability: extent of the service offered in terms of geography, time, frequency and transport mode;
2. Accessibility: access to the public passenger transport (PPT) system including interface with other transport modes;
3. Information: systematic provision of knowledge about a PPT system to assist the planning and execution of journeys;
4. Time: aspects of time relevant to the planning and execution of journeys;
5. Customer care: service elements introduced to effect the closest practicable match between the standard service and the requirements of any individual customer;
6. Comfort: service elements introduced for the purpose of making PPT journeys relaxing;
7. Safety and Security: sense of personal protection experienced by customers, derived from the actual measures implemented and from activity designed to ensure that customers are aware of those measures; and
8. Environmental impact: effect on the environment resulting from the provision of a PPT service. (CEN 2002, 8)

The selection and specification of these criteria is guided by the consideration of the number of passengers affected. The specification of performance levels include four parts:

1. A plain-language statement of the service standard-- e.g. bus cleanliness;
2. A level of achievement, expressed, where appropriate, as a ratio or percentage of passengers affected-- e.g. "80% of customers can expect to find a clean and neat bus with no unpleasant smells;"
3. The threshold of unacceptability; and
4. Redress, in case of failure to meet the threshold. (CEN 2002, 9)

After selection of performance levels, the monitoring scheme is designed in a process of the following 4 steps

1. Selection of measurement methods;
2. Decision about the frequency of measurement;
3. Decisions about the computation and validation of results; and
4. Development of documentation of results

In case of non-attainment of performance targets, a policy for corrective action must be defined. This policy identifies the deficiencies in performance, identifies methods to accomplish the desired performance improvement, and, finally, implements that corrective action. After the customer perception of quality is assessed, action plans designed to reduce the difference between both delivered and perceived quality are developed and acted upon.

2.4.4 Rewarding quality success: integration of quality into a tender

It is common in transport contracts and tenders that a subset of the quality regime be included in both the selection process and in payments for services rendered. In his analysis of contract economics, Halvorsen found that when using incentive packages to stimulate performance improvements, effort must be devoted to make sure that the package does not provide incentives such that the contractor seeks to optimize only the factors within the incentive scheme to the detriment of the factors which are not included within the incentive scheme (e.g. preventative maintenance of publicly owned vehicles).

From a theoretical perspective, there are several types of incentives applied in transport contracts. Two of the most prominent incentives are financial and reputational. Financial incentives are direct increases or reductions in payments applied to the set value of the contract-- effectively setting a price for quality. It is for this reason that the definition of incentive and penalty amounts requires a good deal of thought in order to properly price quality; if a financial incentive is intended to stimulate performance enhancements on the part of the operator, the incentives must be high enough to entice the operator to improve – above the marginal cost of the improvement. Conversely, penalties must be high enough so that the operator is compelled to maintain constant performance, while not so high to either bankrupt the operator, discourage the entrance of other firms into bidding initially for the contract, or result in political lobbying against the contract structure. Additionally, if penalties are severe, the contractor bid may come in higher to account for the amount of expected uncertainty in penalty assessment or fewer contractors may choose to enter a bid, diminishing the positive aspects of competitive bidding. This calculus, along with defining the quality areas to be measured, is often the most difficult part of the bidding and contracting process.

Reputational factors are related to the reputation of a firm within a field of competitors. This can be non-tangible, yet most concessionaires strive to maintain a good relationship with the government agency in order to maintain a reputation within their market for quality; for firms seeking to expand their business, reputation is a key factor in obtaining other contracts. If a concessionaire has a good working relationship with an agency, that agency may be provided as a reference in future contract bids. Furthermore, a good working relationship and reputation allows both the government agency and the concessionaire to reduce the resources involved in contract administration, as greater trust results in less effort expended on oversight. A reputation-based penalty can be included in a contract by allowing the agency the power to both conduct audits of the contractor and to report the contract performance publicly.

In addition to direct financial and reputational incentives, there are several smaller penalties or incentives that are typically included in transport contracts. The first regards the length of the contract. Most contracts will allow for the agency to terminate the contract under the grounds of failure to perform. Conversely, if a contractor has been achieving the targets set within the bonus scheme, along with maintaining a good reputation, contracts commonly allow for extensions. Another is a non-economic penalty applying to individuals, whereby the agency has the power to prevent certain individuals (key managers or serious rule infractors) from continuing to work on the contract. This can be difficult to include and may present liability problems, but can be useful when an employee repeatedly provides inaccurate information or attempts to improperly influence auditors or inspectors (Halvorsen 1993, 60-61).

Moving beyond theoretical contract economics, the European Union's QUATTRO project, after careful study of contract practice, defined three major methods used in tenders:

1. The tendering authority defines the minimum standards of quality in the tendering documents;
2. The tendering authority uses preset quality criteria in evaluating the bids and selecting the operator. The quality of the various bids is used as well as their price in the selection process by attributing an additional cash value to the bids that announce quality goals in excess of the minimum standards; and
3. The authority rewards good service and the operator has value deducted if during the contractual period, the levels of quality actually provided do not match the standards agreed in the contract.(OGM s.a. 1998, 138)

In the third example, when quality criteria are used to determine payment adjustments, the QUATTRO project further identified 4 common methods for attributing value to quality:

1. Each quality criteria is associated with a certain weight (%) in relation to the price of the tender;
2. The price of the tender is adjusted by a given cash sum for each quality determinant whose proposed level differs from the required level;
3. The compensations promised to the operator by virtue of the contract are decreased if the service delivered did not match the standards of quality which had been agreed in the contract; and
4. The operator is given a reward/bonus depending on the rate of approval obtained for his services in customer satisfaction surveys.(OGM s.a. 1998, 139)

The use of ridership based bonuses tends to improve service quality while reducing the risk of redirection from necessary, yet unmeasured objectives. Revenue sharing between the agency and operator is another type of incentive which can provide similar benefits to ridership-based bonuses, although in the case of low fares, high per-trip subsidies, or a low farebox recovery rate, the contractor's internal valuation of this future revenue will be discounted lower and it may not be sufficient to compel service quality improvements. It is for this reason that ridership bonuses are considered superior in longer-term contracts. (Halvorsen 1993, 61)

2.4.5 Mitigating the Risk of Failure: Dynamic Benchmarking

Blakey (2006) proposed a performance regime structure for public transport concession contracts designed to "support the effective and efficient achievement of the public's goals for transit during periods of uncertainty and ambiguity" (Blakey 2006, 13). This regime was based around the concept of dynamic benchmarking. Many factors that influence public transport usage-- namely the economic and employment conditions, as well as changes made at the strategic and tactical levels of service design-- are not wholly within the control of the private operator. Resetting benchmarking targets dynamically allows for performance targets to be set first using the best information available, then adjusted dynamically given actual performance.

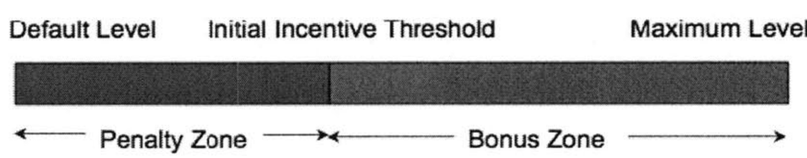

Figure 2.3: Dynamic benchmarking example 1

Thresholds for penalties and incentives are defined in the same manner. These thresholds are defined as default, initial, and maximum. At the default level, the service is not meeting contractual obligations. This must be defined carefully, as contract termination or corrections can be expensive for all parties involved both politically and economically. The maximum level is the highest conceivable performance of the service. These targets must also be defined carefully, in order to entice the contractor to attempt to achieve the maximum performance and thus obtain the maximum bonus. The initial level is set prior to the first year of service, and represents the expected results for the contractor. Default and maximum levels should not change after initially set. Furthermore, the initial threshold sits between the penalty and incentive thresholds. Performance within the penalty and incentive thresholds (the "neutral zone") does not result in an applied incentive. This is done so that the effect of stochastic (random) incidence unrelated to performance does not influence the amount paid to contractors.

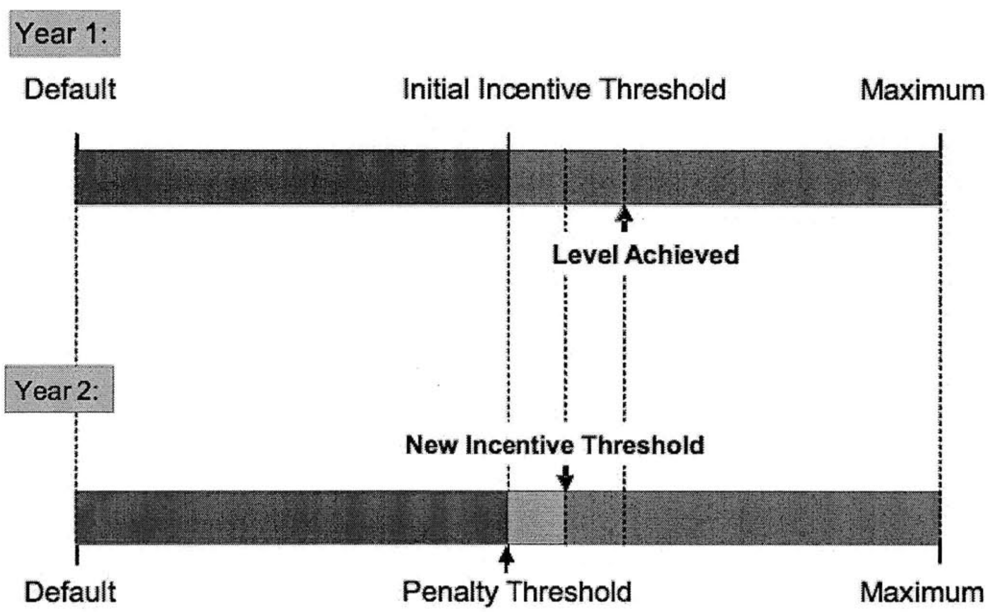

Figure 2.4: Dynamic benchmarking: incentive threshold resetting

After the initial year, in the case of improved performance, the next year's incentive threshold will move halfway between the measured performance and the previous year's incentive threshold. If performance is below the incentive threshold, the penalty threshold is reduced to the halfway point between the prior threshold and the achieved performance level, while the incentive level remains fixed. Downward resetting ensures that the contractor receives a fair deal when targets are set unrealistically high. Only the incentive or penalty level may be adjusted in any given year.

To further level the field, and to reassure that there will be no surprises for both parties, a floor and ceiling could be applied to the spectrum. Given that neither party would like to be responsible for absorbing the cost of an exceedingly large payment modification from year to year, these thresholds determine both how low the penalty level may fall and how high the bonus level may rise from one year to the next. The bonus ceiling compels the contractor to improve after a particularly good year, while the penalty floor shields the contractor from unreasonable expectations.

The objective of this model is to encourage contractors to make continuous improvements to service, while taking into account the multiple levels of uncertainty-- namely projections on ridership or any other performance measure and the possibility of errors in projections. A further objective is to create a good working relationship between the contractor and agency, given that there is an equal ability to both raise and lower the incentive and penalty targets and thus no obvious perception of one side having an advantage.

2.5 Conclusion

There is a wide variety of literature on contracting and performance measurement in the public transport context. This chapter presented an introduction to that literature to be used in analysis of current organizational, contractual, and performance structure in Chapter 3. These topics also aid in the formation of a framework for interurban bus contracts in Gipuzkoa-- covering both the contracting and performance measurement regimes.

3 Case Studies of Current Practice in Contracts

The public transport literature grows evermore as more experience is gained with various forms of organizational structure and the contractual relations that follow them. While Chapter 2 presented a survey on the theories and models behind contracting and performance measurement, this chapter seeks to unite the topics presented previously with the state of the practice in contracts that contain performance measures. Each has adopted an organizational structure that reflects local priorities on service quality attributes. The cases presented within this chapter have been chosen due to the insights that they present in what has and has not worked well for authorities while contracting public transport service.

It begins with a summary of the conclusions from case studies discussed in a previous thesis. It then continues with an analysis of the bidding and performance regime in London Bus and the UK Rail, which maintains one of the largest and most elaborate bidding regimes, as well as one of the most complex performance regimes. Next, the history of contracting in Stockholm is presented, with an emphasis on the lackluster effects of the specified performance regime. Finally, a Spanish example is presented in the autonomous community of Catalonia.

3.1 Summary of Previous Case Studies

Blakey (2006), in her work on concession schemes that respond efficiently in the face of uncertainty, summarized the results of performance regimes in Melbourne, Australia and Copenhagen, Denmark. These two cases, along with the cases presented in Sections 3.3-3,4 below, show different paths taken in decision-making during contract design.

3.1.1 Melbourne, Australia

Melbourne began a path towards privatizing the public transport sector in the early 1990s, and this process was completed 1999. Accompanying this was a move towards drastically increasing service quality and ridership. Contracts were originally structured such that the operator's profitability depended on the results of increased fare revenue. This revenue did not materialize and left Melbourne's transport network on the brink of collapse. In early 2002, after receiving threats from the operators that the current operational situation would force them to pull out of the market, the government announced that it would pay the three private rail and tram franchisees an additional AU $105 million. This sum was not the last payout given to operators– the government further agreed to pay operators an additional several billion dollars to repurchase infrastructure and maintain service (Mees 2005).

In 2003, this regime was re-negotiated in an attempt to stabilize it. A safety net was added, where the state pays the contractor 75% of any shortfall in expected revenue. Additional incentives (known as the Operational Performance Regime, or OPR) were also offered to reduce the amount of excess waiting time incurred by passengers. Cancellations, short turns, and early vehicles are assigned a predetermined minute value based on the agency's perception of severity. In accordance with keeping a customer focus, the time value for each incident is weighted by the number of passengers affected. The sum of these "passenger-weighted minutes" is then reported monthly and rewarded if it falls below the defined target. Disruptions such as force majeure events, suicides, fires, state planned projects, and special event services are not penalized.

In addition to the OPR, several further modifications can be made to contract payments. The Service Growth Incentive (SGI) rewards operator-implemented increases in frequency based on the estimated marginal cost for providing the extra service, based on the difference in cost in providing service between peak and off-peak periods. This includes an annual cap of $4 million in bonuses.

3.1.2 Copenhagen, Denmark

Copenhagen is the capital of Denmark with a regional population of nearly 2 million. Following in the footsteps of London (see Section 3.2), Copenhagen began to tender its bus operations in 1990. The authority, Movia (formerly HUR) retains both the strategic and tactical roles, while private operators assume operational responsibilities through the process of competitive tendering. The resulting contracts have a duration of six years with the possibility for extension. The incentive amounts within a contract can be up to five percent of the total contract value, with the possibility for penalties of a greater magnitude (KPMG LLP 2009, 96). Perhaps the most interesting aspect of theses contracts is that the incentive contracts focus primarily on customer satisfaction as measured by regular customer surveys.

These surveys collect customer responses, rating nine measures on a scale of satisfaction ranging from 1 (very dissatisfied) to 5 (very satisfied). These responses are then scaled into a quality index (QI) with a maximum of 1000 by using each measures predetermined levels of importance. A sample QI calculation is presented in Table 3.1.

Measure	Target	Importance	Contribution to QI
Outdoor cleaning and maintenance	81	0.65	52.65
Interior cleaning	81	1.08	87.48
Interior maintenance	81	1.15	93.15
Temperature	81	1.17	94.77
Ventilation	81	1.13	91.53
Confinement of noise	81	0.96	77.76
Keeping to the timetable	81	1.4	113.4
Driver's standard of driving	81	1.37	110.97
Driver's service and appearance	81	1.09	88.29
Total Quality Index			810

Table 3.1: Sample Copenhagen Quality Index Calculation, (GCA 18th Invitation to Tender, as cited in Blakey,)

Bonuses and penalties are calculated based upon the difference between the calculated QI and a previously specified target QI. Further information on the relationship between QI and payment can be found in Blakey (2006, 50-53).

The resulting incentive amounts are scaled based upon the delivered amount of service; bonuses are only applied for amounts delivered above 99% of scheduled bus hours for all routes during the contract period. Furthermore, for defined quality infractions, such as early or delayed departure from the terminus, incorrect information signs, or failure to meet cleanliness standards, per-incident penalties of €30- €400 can be applied.

Copenhagen's experience has been positive overall, with falling costs and increasing ridership. Customer service perceptions remain high– in 2001, 94% of customers were satisfied with service, while only 1.4% were dissatisfied.

3.2 Bidding and Performance in London Bus and UK Rail[1]

In 1986, as a wave of deregulation passed over the United Kingdom, buses outside of London were deregulated. Operators were expected to "compete in the street" for passengers and were free to add and withdraw service as they saw fit. It was assumed that the threat of competition would lower costs and increase service quality. The actual results of deregulation in the UK, however, did not show increased competition (Rye and Wilson 2002). London was exempted from deregulation at that time, as it was thought that bus services in the capital would become less dependent on government subsidies. Although it was originally intended that the London market would become deregulated, the national experience with deregulation let to the development of a system of regulated competition through tendering.

Each route in the London urban bus network is tendered and awarded on the basis of both cost and cost-effectiveness. Tendering enables TfL and London Bus Services Limited (LBL) to plan, procure and manage a network of services in a consistent and coordinated manner. LBL plans routes, specifies service levels and ensures service quality. It is also responsible for bus stations, bus stops and other support services. The bus services are operated by privately owned operating companies, which work under contract to London Buses. The companies holding these contracts operate over 7,000 buses for service on 700 routes and provided 2.18 billion passenger trips in 2008.

In addition to bus concessions, the United Kingdom also tenders rail franchises in a similar manner. The rail infrastructure involved makes management more complex than bus, and in this

1 Information on bus tenders from Transport for London (2009), information on rail franchise tenders from DfT National Networks Group (2010).

case, operations, maintenance, and management are tendered out in a process that involves greater detail in comparison to the London bus context. Both the rail and bus tender processes are described further in the following sections.

3.2.1 History of the System

As a part of the path towards tendering, in 1985 London Transport (LT) set up LBL to coordinate its bus services. The tactical level (specifically route planning and fare structures), however, remained the responsibility of LT. That very year LT also set up the Tendered Bus Division to begin the administrative process of competitive tendering for operations. LBL's existing operating division was broken up geographically into 13 separate companies to compete against each other and newly arriving private operators. As a result of the tendering process, routes were awarded to the bidder which proposed the best package balancing service at the most cost-effective price. About 40% of the initial contracts were awarded to private companies rather than the incumbent LBL. Each year since 1985, 15% to 20% of the routes within the London Bus Network have been tendered.

In 2000, Transport for London replaced LT as the integrated body responsible for providing the organizational and high-level tactical responsibilities for London's transport system. TfL operates under the strategic guidance of the Mayor of London and the Greater London Authority, and administers the London Underground, London Buses, the Docklands Light Railway, among others as well as supports alternative mobility such as cycling and walking. Under this current situation, the strategic direction is set by the Greater London Authority and the Mayor of London, while tactical responsibilities are held by Transport for London and LBL, and operations are performed largely[2] by private operators. The operations responsibilities of LBL and its subsidiaries have been gradually replaced through the privatization process.

2 In order to lower initial costs, thus easing entry for smaller operators into the London market, TfL maintains ownership or control over 11 of the 88 bus depots in the Greater London Area (KPMG LLP 2009, 33),

3.2.2 Bidding Process

The following general procedure applies to both bus route tenders in London and rail operations tenders in the UK. A detailed graphical overview of the rail-specific process is shown in Figure 3.1. A high-level description of the tendering process for buses in London is very similar to the rail process and is not shown here.

In London, bus routes are tendered individually, with the exception of a few cases, most commonly in the case of a service that is provided 24 hours per day where both day and night service are tendered together (London Assembly Transport Committee 2006, 24). The initial bid document published by LBL, known as the Invitation to Tender (ITT), is provided to pre-qualified bidders with additional information such as:

- Specific streets and routes buses are to follow;
- The frequency of the service for various time periods during the day and week;
- Departure times for the first and last buses of the day;
- Type and capacity of vehicles to be used;
- Current running times; and
- The Minimum Performance Standard defined for the route. (Transport for London 2009, 10)

Before submitting a bid, an operator must follow a procedure and be pre-qualified according to specific criteria, assessing the financial stability of the company, health and safety practices, and previous experience in the transport or services sector. After the pre-qualification, operators have a chance to submit a pro-forma "dummy bid," to which the authority will respond with feedback.

In responding to a tender, the operator provides a schedule for the level of service provided, as well as the total estimated cost of providing the service. The more involved rail tendering process compiles information on costs in a complex spreadsheet that specifies detailed costs for all types of staff, rolling stock acquisition and maintenance, costs of capital, and financial expenditures.

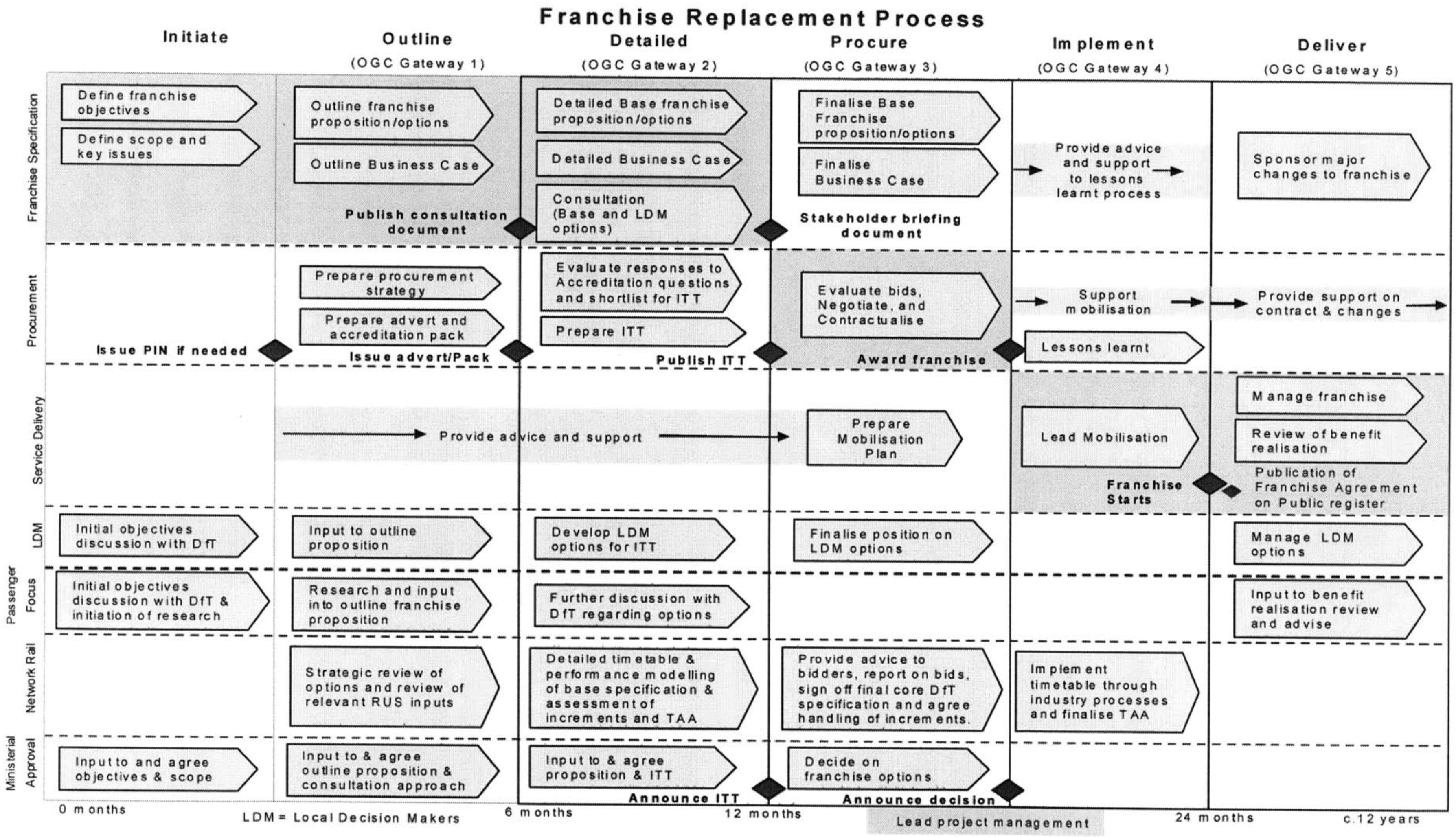

Figure 3.1: UK Rail Franchise Process

After submission, these tenders are then evaluated according to the following criteria (in no particular order):

- Price – Ability to deliver quality services - to at least the levels specified in the ITT
- Staffing – ability to recruit, train and retain staff of a suitable caliber
- Premises – status of depot, and/or ability to obtain a suitable depot
- Vehicles – type proposed and any additional features offered. This includes ability to maintain vehicles in an acceptable condition through the life of the contract
- Financial Status – the resources to fund the start up costs and provide stability over the contract term
- Schedules – compliance with the specifications
- Health and Safety Policy and records
- Sustaining competition for tendered routes – i.e. not awarding a monopoly position to one operator. (Transport for London 2009, 12)

With regards to determining an adequate price, TfL/LBL creates with each tender a "shadow bid." an estimate of the costs for providing service along the specified route, which remains hidden from the operators. These bids are the product of years of experience and are created to reduce the incidents of an operator underbidding for a service.

After a bidder has been selected, a process of negotiation begins between the operator and the tenderer. Through negotiation the details of the service to be provided are finalized, including any proposed additional investments or service that the bidder has offered. After this, the final "mobilization / transition / migration" plan is established, making sure that all of the contractual requirements are in place before the commencement of the contract.

3.2.3 Contract Structure and Performance Incentives.

After the introduction of competitive tendering under both LT and TfL, there have been three forms of contracts under which tenders have been offered. These are:

- Gross Cost Contracts, between 1985 and 2000;
- Net Cost Contracts, between 1995 and 1998; and
- Quality Incentive Contracts, from 2000 onwards. (Transport for London 2009, 8)

Gross cost contracts, where the operator tenders for a fixed cost for operations and revenue risk was retained by TfL/LBL, were the first and most commonly offered type of contract until 2000. These contracts included standards for reliability, and operators were not paid for trips that were not made (within reasonable control by the operator). For a short period gross cost contracts were replaced with net cost contracts, although the experience was not overwhelmingly positive. Further information on the progression of the contract structure can be found in Blakey (2006, 58-60).

In 2000, the gross cost model was revamped into what are referred to as "Quality Incentive Contracts" (QICs). While TfL retains the revenue, QICs tie financial incentives to good performance, something that was absent in the previous net- and gross-cost contracts. There are three types of incentive in the most recent active QICs-- **reliability performance payments, contract extensions, and quality performance payments.**

Reliability performance payments are calculated on an annual basis by comparing the difference of the Operator's annual reliability performance on each route against the contract's minimum performance standard. For high-frequency routes– those that have more than 5 buses per hour – this is calculated in "steps" of 0.1 minutes Excess Waiting Time (EWT). The difference between the published headway and the actual headway is used as a basis for this measure. EWT is measured at least 16 times per quarter by individuals placed in the field positioned at certain points along a route[3] (London Assembly Transport Committee 2006, 9).

The goal is that the average passenger will not have to wait more than half of the scheduled headway-- i.e. reduce EWT to zero. For low-frequency routes, the "steps" are calculated as a change of 2.0 percentage points of on time performance– defined as 2½ minutes early to five minutes late.

For both high-frequency and low-frequency routes, bonus payments are paid at a rate of 1.5% of the contract price for each step above the standard. Deductions are made at a rate of 1% of the contract price for each step below the standard. Bonus and deduction payments are capped at 15% and 10% respectively of the contract price. In 2004/05, performance payments reached an

3 The reliance on manual data collection and relatively small sample sizes per time period may show a different picture than the actual on-the-ground operations. Analysis of automatically collected data (AVL/APC/AFC) may be used to provide greater sample sizes and thus, more confidence in the results. For further analysis, see Ehrlich (2010).

average 5.1% of contract value (London Assembly Transport Committee 2006, 27). In 2008/09, this percentage has fallen to between one to five percent of contract value as minimum performance standards were raised. This still happens to be a significant amount given the typical operator's earnings before interest and taxes[4] (KPMG LLP 2009, 52).

London's bus contracts allow for the contract to be extended from 5 to 7 years[5] should the operator exceed certain performance thresholds. The threshold is higher than the Minimum Performance Standard for both EWT and On-time departures defined in the initial tender. Should the operator determine that operating the route is no longer in their best interest, the operator retains the right to reject a contract extension. In that case, the route is re-tendered. Approximately seventy-five percent of contracts have the option of an extension, and ninety-five percent of those contracts are renewed (KPMG LLP 2009, 53).

Quality performance payments are focused on the quality of customer service provided by an operator and are awarded at the garage, and not the route level. They are based upon a combination of Mystery Shopper Surveys, which focus on the customer's experience, and vehicle inspections, which focus on the "fixed" aspects of service delivery (e.g. etching, graffiti, structural damage). Payments or penalties are calculated against a network-wide standard that rewards the companies with higher performance.

The experience after the deployment of QICs has been seen as very positive. Both passenger journeys and bus-km operated have grown, as has the average number of bids placed for route operations. A further analysis of the post-implementation results of QICs can be found in Blakey (2006, 62-65)London Assembly Transport Committee (2006) and KPMG LLP (2009).

4 In 2007, the year which the most recent data are available, operator earnings before interest and tax ranged from approximately 1-13%, with most operators in the range of 7-11% (KPMG LLP 2009, 36).

5 It should be noted that this is a shorter duration than the 8 to 10 year contract lengths typical within the continental EU (SPUTNIC Project 2008, 9), but longer than the typical 3-5 year contract durations in the United States (Committee for a Study of Contracting Out Transit Services 2001, 9).

3.2.4 The Future of QICs

There are two major issues on the horizon for the future of QICs-- the possible introduction of an additional, new generation of standards (also known as the QICs 2); and the overall reduction of QIC payments to operators due to the gradual increase in minimum performance standards.

The QICs 2 extend the current QICs to include incentives for driver performance (professionalism, smoothness of ride, etc), and vehicle presentation (conditions of the bus interior and exterior). The inclusion of passenger experience metrics in contract payment amounts would mirror other performance measurement regimes in mainland Europe, such as Copenhagen (Section 3.1.2). Information for calculation of the QICs 2 was collected by mystery shopper surveys and surveys at the terminals. These new measures were piloted in one depot for approximately six months beginning October 2008. This pilot was further extended for another 6 months (KPMG LLP 2009, 53-54), but was not extended beyond April 2010 (Singh 2009). It is not known if a slightly different pilot program will be performed or if the QICs 2 will be implemented as part of future contracts.

The greatest change coming to the London Bus performance regime is not a structural one. As TfL both approaches budgetary constraints for operations and gains experience with monitoring, minimum performance standards are being tightened with new tenders. As these standards become harder to exceed, it is projected that the total amount of bonus payments will fall (Shaw 2010; KPMG LLP 2009, 52). As a result, operator earnings will fall, and in some cases the economic viability of some of the private operators will seriously deteriorate.

3.2.5 Additional Quality of Service Measures in London Bus Contracts

Beyond direct (paid) incentives within the contract, LBL also maintains one of the most comprehensive standardized monitoring schemes among large public transport authorities (Randall et al. 2007, 6). These additional performance measures are:

> ***Mileage Operated:*** Operators are paid for mileage operated, with deductions for mileage not operated that is reasonably within the control of the operator, such as crew or vehicle unavailability. While not officially an incentive under the QICs, this encourages operators to

run the greatest percentage of mileage possible. The percentage of miles operated has undergone a substantial improvement over the past 10-15 years.

Reliability: Reliability relates to the "assessment of an operator's ability to schedule, control and adjust services." It serves as a basis for the main financial incentives in the current London Bus contracts. It is measured differently based upon whether a route is high- or low-frequency. On high-frequency services– EWT is used. On low-frequency routes, the measurement is more complex. Beyond on time performance, also measured is the percentage of trips running early– between 2½ and eight minutes ahead of the schedule. Early departures are considered under the control of the operator and are not acceptable.

Driver and Vehicle Quality Monitoring: The Driver and Vehicle Quality Monitoring Program builds on earlier Mystery Traveler Surveys and provides objective service quality measurements for monitoring compliance with contractual requirements. The results are shared with the operators for identifying areas to improve, as well as used by London Buses to calculate financial incentives according to the driver and vehicle quality regime.

Driver Quality Monitoring: LBL also undertakes separate measurements for the assessment of the technical driving skills of an operator's drivers. For each assessment, a driver receives a graded score for a series of measures such as speed, road position and braking and there are over twenty categories per assessment. It is rare for a transport provider to undertake this level of detail in monitoring, in that it considers more than the accidents and infractions of the drivers.

Engineering Quality Monitoring: An independent contractor employed by LBL performs regular checks on the maintenance and mechanical condition of the vehicles used in providing contracted service, similar to an annual safety inspection for cars. Approximately 25% of the fleet is inspected per year. Defects are assigned a number of points against a predefined scorecard, with a target of an average of zero points per vehicle throughout the fleet. Also monitored are the quality of maintenance procedures and the annual pass rates of the operator's vehicles.

Customer Satisfaction: LBL performs three Customer Satisfaction Surveys (CSS), focusing on Bus Services, Night Buses and Bus Stations. These surveys are conducted face-to-face with passengers alighting from buses. The questions focus on the journey that has just been made specifically regarding the passenger's perceptions of overall satisfaction, information, safety and security, cleanliness, reliability and staff behavior.

Public Correspondence Data: LBL collects all public communications made by phone, email or letter. These data are analyzed at the route level and is broken down into various themes including driving quality.

Contract Compliance Audits: LBL conducts audits to ensure that the management processes are functioning correctly to comply with the terms of the contracts and that LBL-owned equipment is being maintained correctly. Furthermore, they focus on compliance with labor and wage regulation and the competence for monitoring of mileage.

Safety: LBL monitors various measures to assess the safety of the service an operator provides. Failure to meet these expectations can result in the loss of a contract and failure to win new contracts. This incentive is not financial, as it is considered that safety should not be assigned a value as a small percentage of the contract. The measurements do not involves the customer experience, but take into account the operator's standards-- derived from interviews and visits to the operator's premises-- with regards to safety.

Other Sanctions and Remedies: Regular reviews of the measures described above are undertaken by LBL management. In the case of unsatisfactory performance, discussions are held with individual operators, who may be required to implement solutions to resolve performance issues. In new tenders, operator reputation and past performance are taken into account in the recommendation for awarding of contracts. While LBL normally resolves performance issues through management, the right to terminate any contract in the case of poor performance is retained as an ultimate sanction. (Transport for London 2009, 18-22)

Each of these measures is compiled to determine the overall health of the system. Specific data is shared with the appropriate operators and measures are aggregated at the network level and published on TfL's website. These measurements are also taken into account as a proxy for the operator's overall performance in the extension of the current contract and the acceptance of future bids by the operator.

3.3 *Stockholm, Sweden*

Stockholm County is the largest region in Sweden, home to over 2 million people. More than half of the public transport trips within the country are taken within the Stockholm region, a figure of nearly 2.4 million boardings per day. At the beginning of the 1990s, Stockholm was one of the first cities in Europe to introduce competitive tendering for the operation of public services. As in London, the previously wholly public-owned company, AB Storstockholms Lokaltrafik (SL) was broken up into a managing authority and smaller units which operate the bus and rail services along the network, as well as others that maintain infrastructure and real estate (Nordstrand 2005, 3). The resulting operating contracts include a variety of performance measures, the effects of which have been analyzed and summarized below.

3.3.1 History of Tendering and Organizational Structure

For the first round of tenders released between 1991-1993, SL, now divested of its operational capacity and retaining the strategic and tactical capacities, elected to use a gross-cost contract model for payments to new operators. While marginal incentives and penalties were assessed for punctuality and cancellations, there was no further consideration of quality measures in payments to operators. The initial duration of these first contracts was three years without the possibility for extension.

The use of gross-cost contracts in the first contracting regime had good results for driving down subsidies-- from approximately 75% to 50% of total costs – and reducing the number of vehicles required for service by 15% (Nordstrand 2005, 5). These initial cost reductions were established through two mechanisms. First, efficiencies were gained before and after the implementation of competitive tendering, lowering cost to the authority. The second mechanism was not as positive; prices offered in the bidding process were too low to support sustained profitability for the operators. As the initial contracts progressed, customer service deteriorated as further cost reductions were made at the expense of service towards the end of the three year contract periods.

The first round of contracts also resulted in political opposition towards SL, as under the new regime, drivers and other staff were not guaranteed to retain their jobs after the end of a tender.

In response to the aforementioned issues, major changes were made to the contracts in 1995 and 1996. First, five year contract terms replaced three year terms; in 1996, it was decided that re-tendering would be only done only "when necessary–" after the initial five year period, the contract may be renewed for an additional five years. After renewal, either party can terminate the contract given 15 months notice. Additionally, through a new collective agreement employment conditions were harmonized between employers and drivers were guaranteed to retain their positions. Further changes were made in 1998, which recognized that gross-cost contracts were not providing adequate incentives for much more than cost reductions. SL began to focus on quality, strengthening long-term business relations, and intensified control and monitoring. The contract winner was now to be evaluated not only on the lowest price, but the best bid balancing cost and quality (Nordstrand 2005, 5-6)

3.3.2 The Incentive Regime

SL also introduced further quality incentives into contracts, providing a new opportunity to enhance the operators' profitability. Given the lack of profitability in the previous contracts, during discussions on incentive structure the operators were fixated solely on improvements in profit margins and not on which areas of quality were seen as important or which indicators were to be measured. The revised incentive regime included the following indicators to be included in the basis for payment:

- Punctuality,
- Number of passengers,
- Staff behavior,
- Cleanliness of stations and vehicles,
- Graffiti, and
- Fraud. (Nordstrand 2005, 7)

These incentives are measured by several means. In the original monitoring scheme, SL directly measures canceled departures, punctuality, passenger complaints, conducts surveys of passenger satisfaction and retains a consultant to conduct Mystery Shopping Surveys. For one contract during the year 2006, the range of penalty and bonus payments was between -€200,000 and €4,000,000 out of a base contract value of €17 million (Inno-V et al. 2008b, 85).

The amount of these incentives was set to increase or decrease linearly with the amount of positive or negative effect on the passengers. For delays greater than one minute in both departures and punctuality, the incentive amount was calculated as a function of a defined value of time (€2/hour for in-vehicle time, €6/hour for waiting time[6]) multiplied by the amount of delay in passenger-minutes. On two targeted routes, the operators were offered a bonus was €2 per additional passenger[7]. For customer experience incentives– driver attitude and vehicle cleanliness– the incentive increases from €0.01 to €0.07 per passenger for improvements over a defined benchmark, while the penalty increases to €0.03 per passenger at the lowest acceptable level (Jansson 2004).

Additionally, in 2006 SL began experimenting with setting the incentive levels using a willingness-to-pay (WTP) metric. An estimate is made on passengers' valuation of time during delays, and incentives or penalties are assessed on the operator based upon not only the presence of a delay, but the length of the delay. This methodology is believed to result in near-optimal incentives.

The effectiveness of the quality measures described above was analyzed by Jansson and Pyddoke (2005; 2007; 2009), which are summarized in the next section.

6 It should be noted that this is a very low value, especially for a Scandinavian country with a high cost of living. The average hourly wage for manual workers in Sweden in 2009 was 140 SEK/hr, or approximately €14.5/hr (Statistics Sweden n.d.). Wages in Sweden have risen approximately 36% since 1999, the year of the introduction of the Euro (EuroStat n.d.) A simple calculation estimates that the approximate average hourly wage was 98 SEK/hr (or roughly €11/hr) in 1999.

7 "These €2 can be related to the average ticket price, which is approximately €1, something that might be seen as somewhat remarkable." (Jansson 2004)

3.3.3 Effectiveness of the Incentive Regime

In their first work, Jansson and Pyddoke (2005) found mixed results from the implementation of the incentive regime in three geographical contract areas. This analysis was performed using simple statistical difference-of-means tests for analysis of performance before and after implementation. Like many other statistical analyses, the major caveat to this approach is that if there were other, exogenous factors not controlled for, the results will not reflect the true impact of the incentive regime.

Positive results were found from the implementation of incentives for on-time departures and total quality. Inconclusive, or even negative results were found regarding the effect of incentives in the areas of cleanliness, information provided to passengers about delays and cancellations, and driver conduct. Furthermore, the number of complaints grew on the lines analyzed, showing either the lack of a relationship between the incentive and quality, external factors not accounted for, or an insufficient incentive to compel operators to improve quality. Beyond the statistical analysis, four additional points were made:

- The introduction of incentives seems to have proceeded in a somewhat ad hoc fashion. In some cases measurements of the quality variables had started well before the incentives were introduced. In others, benchmark data were unavailable. Furthermore, there does not seem to have been any systematic plan to evaluate the incentives after implementation.
- The number of incentives was large and varying and it is not always clear why a particular incentive was chosen.
- The amount of incentives offered was related to arbitrary percentage figures, and are not related to the valuation of increased quality of service. (Jansson and Pyddoke 2005, 9)

The enthusiasm for incentives led to a lack of structure used by SL in defining the incentives and measurements, and was believed to be at fault for the lackluster results of the first performance regime.

Jansson and Pyddoke's second analysis (2007) extended the statistical analysis of the first. Using Ordinary Least Squares (OLS) regression, they analyzed the relationship between incentives, results, and other explanatory policy and ancillary variables, such as:

- The presence of an incentive,
- Punctuality,
- Canceled departures,
- Bus arriving at terminal in advance of departure time,
- Validation of tickets/ incidence of ticketless travel,
- Cleanliness, staff behavior, information,
- The number of days with more than 5mm of precipitation,
- Service speed (bus services only), and
- The number of passengers boarding the service. (Jansson and Pyddoke 2007)

Regressions based upon these variables were performed for four geographical areas of bus service and three subway lines. Another set of regressions was performed on commuter rail services using different explanatory variables.

Surprisingly, even when using the OLS methodology to control for certain variables, the incentives offered for punctuality did not always result in measurable quality improvements. With the exception of one bus area and the commuter rail services, the incentives were not found to have improved punctuality. In fact, in several cases the coefficient for the dummy variable representing the presence of an incentive was negative and statistically significant, implying that the incentives actually had a perverse effect on the punctuality of the service. While it is unlikely that this is the case, it is obvious that simply the presence of an incentive did not compel the operator to improve.

For canceled departures, more information was available on the causes of cancellations, and this provides additional insight into the analysis. Operators were required to submit what was the root cause of a cancellation-- a shortage of staff, vehicles, or another reason– and this information was included in the analysis. In the cases presented, the presence of an incentive oddly coincides with a small, yet statistically significant increase in the number of cancellations. More illuminating is the cited causes of departure cancellations:

	Staff	Vehicles	Other
Average cause for cancellation of trip	25%	62%	12%

Table 3.2: Causes for canceled departures for Söderort from January 2000 to December 2006

The overwhelming number of cancellations due to vehicles suggests that the operator was having trouble providing functional vehicles, and to a lesser extent, additional drivers. This may be due to an incentive insufficient to entice the operator to maintain additional vehicles or drivers, or, an overly optimistic view on the part of the operator about the ability of its existing staffing levels to meet operating requirements.

The fundamental recommendation out of this study was to increase the incentive amounts to a level that was slightly greater than the operator's willingness to pay for additional vehicles and drivers-- as the operator is assumed to be profit-maximizing, the benefits must exceed the cost, and the level of incentive was not believed to be enough to entice sufficient improvement. A further recommendation was to decrease the complexity of the incentive regime, which would allow for cost savings both for SL and the operators by reducing monitoring costs.

Jansson and Pyddoke's third and most recent paper (2009) provided additional regression-based analysis, comparing the original incentives with the post-implementation results of the new WTP based incentives. In the commuter rail context, while incentives for punctuality did not correlate with an increase in on-time departures, it was found that the introduction of incentives for canceled departures (a factor more in control of the operator) resulted in a decrease in cancellations.

In the bus context, the effects of incentives for both punctuality and canceled departures in two geographical areas were analyzed before and after the introduction of the new WTP incentives. As in the previous work, the results were mixed. In one area, metrics for punctuality and canceled departures improved significantly after the introduction of WTP incentives, while in the other area they did not. This may be due to the second operator not placing as much value on the potential future incentives as on the upfront costs that need to incurred to ensure quality improvements. Given that this incentive is calculated based on estimates of passengers willingness to pay for waiting and delay time (a paltry €6/ hour), the value of passengers' time may not coincide directly with the investment required by an operator to produce the desired quality outcome.

The paper concludes with several observations. In addition to those recommendations presented above, Jansson and Pyddoke note that even with the WTP-based incentive, the monetary value of bonuses and penalties may be too low compared to the cost of actually improving service quality. Furthermore, consideration for the influence of exogenous factors (traffic, weather) on incentives was not included in the contract structure. Exogenous factors relating to service provision that negatively effect the operator will often be cause for negotiation and modification of the contract. Attempting to maximize profits, it is possible that operators will try to modify the contracts to obtain rewards for their services more generous than originally intended-- a process known as "contract sliding." Robust contracts should try to minimize sliding by taking into account the possible effects of exogenous factors, especially if the operator is relying on incentives for a significant portion of its profit.

3.3.4 Conclusions

The experience with incentives in Stockholm, while mixed, provides an interesting example of what happens when an incentive scheme is not perceived to be strong enough to compel widespread improvement from operators. The greatest lessons taken out of this case study are:

- An incentive regime should target specific areas and not be applied in an *ad hoc* fashion.
- At least initially, monitoring and incentive regimes should be kept simple for the benefit of both the authority and the operators.
- Bonus amounts and targets should be defined as an economically optimal amount– greater than the operator's costs (i.e. greater than the operator's willingness to pay under optimal conditions) for quality improvements – and not arbitrarily based upon percentage figures.
- Responsibilities for the effects of exogenous circumstances on incentives should be included in contract language.

3.4 Catalonia (Spain) Interurban Bus Quality Regime

Catalonia, the northeastern most region of Spain, has a population of 7.3 million (2010), centered around the cities of Barcelona, Tarragona, Girona, and Lleida. At the beginning of the 2000s, the population of Catalonia was projected to grow steadily (from 6.35 million in 2001). This, in addition to the improving socioeconomic conditions of the region led the Government of Catalonia to demand more effectiveness, efficiency, and quality from its public services. The coordination of public services and the development of a common set of quality criteria for services was an integral part of this movement.

In 2001, the interurban bus network was united under a common brand. In that same year, a common fare structure was also instituted for the Metropolitan Region of Barcelona. It was expected that the common brand would present a high-quality service that would be seamlessly integrated from the user's point of view. It was not until 2003, however, that legislation was passed introducing the concept of "Improvement and Innovation Plans," which required the certification of quality delivered in the course of normal service. The method decided on to implement this certification was the usage of EN 13816.

As EN 13816 requires that each national standards body to define the specific quality criteria and the Spanish certification body (AENOR) had not yet defined a the criteria for interurban bus transport, the Government of Catalonia's Department of Ports and Transport (*Direcció General de Ports i Transports,* or DGPT) worked with the both the CETMO foundation, a non-profit organization devoted to improving competition and quality of service in the Spanish transport sector, and AENOR to develop guidelines for implementation of EN 13816 in the Spanish interurban bus context. These guidelines were published in 2006 and the principles therein were enacted starting in 2008. As of this writing, there has been no published analysis of the results of this implementation; thus this section summarizes only the pre-implementation work of this process. The original work can be found in Fundación Cetmo (2006a; 2006b), which present an excellent Spanish language introduction to much of the material on service quality covered in Chapter 2.

3.4.1 Quality Manuals

The first part of process set forth by the DGPT requires that the operator create a "manual of basic service characteristics," equivalent to an ISO 9001 quality manual. This includes a general definition of service characteristics and the development of a quality management system, including a selection of service quality measures that fall under the eight areas addressed in EN 13816:

1. Offered Service
   The operator must take initiative to evaluate the balance between supply and demand. Data gathered during this process can be presented to the DGPT so that additional service or service modifications can be considered for implementation.
   When the offered service is not conforming to the published standards, the operator must perform corrections to bring service quality levels back to conformity. The operator must also maintain a registry of the nature of non-conforming situations and breakdowns, and actions taken to correct them. This should lead to policies for service breakdowns, minimizing the impact on travel time for customers.
2. Accessibility
   Operators must maintain their fleets to provide the percentage of handicapped-accessible vehicles in accordance with regulation and the innovation and improvement plan.
3. Information
   On the vehicle, the operator should provide information on the exterior– destination and route – and in the interior -- a minimum one copy of the schedule, fare information, and methods to contact the operator. In case of planned service interruptions, the driver should provide information on anticipated changes to passengers. All of the above information should be provided at the operator's offices.
4. Time
   Given that measures of schedule or headway adherence are designed to inspire the passengers' confidence in the operators' schedule adherence, the operator should be proactive to manage the customer's satisfaction. The operator provides reports to the DGPT on the on-time performance of services, comparing the actual arrival times to published times. These reports, in accordance with UNE 13816, focus on the number of passengers affected by the disruption.
5. Customer Service
   The operator should provide customers with a help line to answer questions, take complaints and suggestions. All buses should have signage on the interior that identifies the operator.
6. Comfort
   The operator should develop a cleanliness policy, as well as a driver manual, which instructs drivers on how to drive in a method that inspires the security and comfort of the passengers.
7. Security

Operators should develop an emergency management plan, which instructs drivers on the steps to take in common emergencies. Also, operators are required to maintain emergency equipment on buses (extinguishers, exit windows, etc).

8. Environmental Impact
   The operator should assure that all vehicles in service are within levels specified by regulation related to noise and air pollution, hazardous wastes are disposed of appropriately, and records on fuel consumption are maintained.

3.4.2 Customer Charter

Within three years after certification, the operator should publish a Customer Charter summarizing the information in the quality manual, and including several other features:

1. Seat reservations for trips where standees are prohibited;
2. Availability of handicapped-accessible vehicles within the schedules;
3. Placement of updated service information on the internet; also, the operators should make available a channel to make comments, suggestions, or complaints regarding service;
4. A policy regarding delays, including compensation for delays caused by the operator;
5. The operator must specify the means of fare payment and their conditions;
6. The operator must publish the average and maximum age of the vehicles of the fleet; and
7. The operator should obtain an environmental management certification.

3.4.3 Conclusions

While no results have been published since the implementation of quality plans in Catalonia, the implementation of quality management principles in accordance with the EN 13816 standard recognizes the value of defining clear objectives and responsibilities for all parties involved. Asking operators to develop their own quality policies and be certified allows for the additional expertise of a standards body such as AENOR to be drawn upon. This may prove as a worthwhile opportunity for increased collaboration.

3.5 Summary

The cases presented in this chapter have shed a light on a number of pitfalls that may occur in the specification of a contract and performance regime. The following topics include some of the key findings from these cases.

Contract Payment Amounts: Melbourne's spectacular service meltdown due to the reliance on optimistic revenue forecasts, as well as Stockholm's experience with initial bids proposing prices too low to support profitability point out that it is necessary for the authority to verify and confirm the assumptions within the bids presented. Those bids that specify costs that would not allow for a reasonable profit should be rejected or returned to the bidder.

Performance measurement, incentives and incentive amounts: While the methodology varies widely, it is common among all of the contracts surveyed to tie payment to performance. The only somewhat neutral experience presented has been that of Stockholm. It is believed that this lack of response is due to the number (six) of performance incentives specified within the initial contractual regime and the small amounts of payments tied to each of these. For this reason, it is suggested that given a limited budget, the number of selected incentives be limited so that the amounts are greater than the operators marginal costs for quality improvements.

4 A Framework for the DFG's Lurraldebus Operations Contracts – the Proposed Bidding Regime

This chapter begins with a brief history of the transport organizational contract structure in Gipuzkoa, necessary for understanding the current situation. It continues with an introduction to the objectives set out in the draft bidding document for the next concession, in the Donostialdea-Este area (Diputación Foral de Gipuzkoa 2008) It concludes with several important considerations during the bidding process, notably a newly defined bidding regime.

4.1 History of interurban bus organizational structure in Gipuzkoa

As described in Chapter 1 prior to 2006, the interurban buses in Gipuzkoa operated under concession and provided service without a public operating subsidy. As is common in unsubsidized concessions, public control over the service was limited, with the government mostly retaining the right to define routes and set fares and also holding some control over the service frequency. Most of the operational responsibilities were left to the operator and there was no standardized quality management policy in place. This resulted in a gradual reduction in service quality over time and a decline in ridership. Using the STO framework (described in Section 2.3), a graphical description of the organizational structure for interurban bus service in Gipuzkoa prior to the introduction of subsidies and mobility plans in 2007-2008 is presented in Figure 4.1.

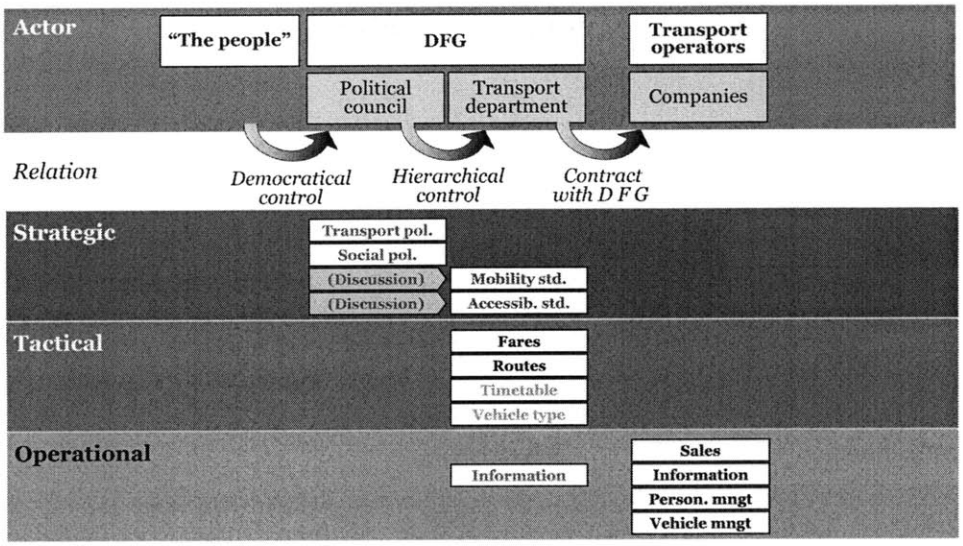

Figure 4.1: Interurban bus transport in Gipuzkoa, pre-2005 Adapted from Inno-V et al. (2008)..

The incorporation of Lurraldebus SL in 2005 and the subsidization of the various operators under the Lurraldebus brand resulted in a major shift of responsibilities from the individual operators to the DFG and Lurraldebus SL. In the new organizational structure, the relations between the three levels of the STO framework (Figure 4.2) are more defined. Seeing "Everyone on Public Transport," the goal in the Lurraldebus project is a far more articulate goal than in the previous situation. That being said, this transition and assumption of responsibility is not complete. The contracts currently in effect for the majority of the operators do not directly tie either quality of service or the amount of service to payments.

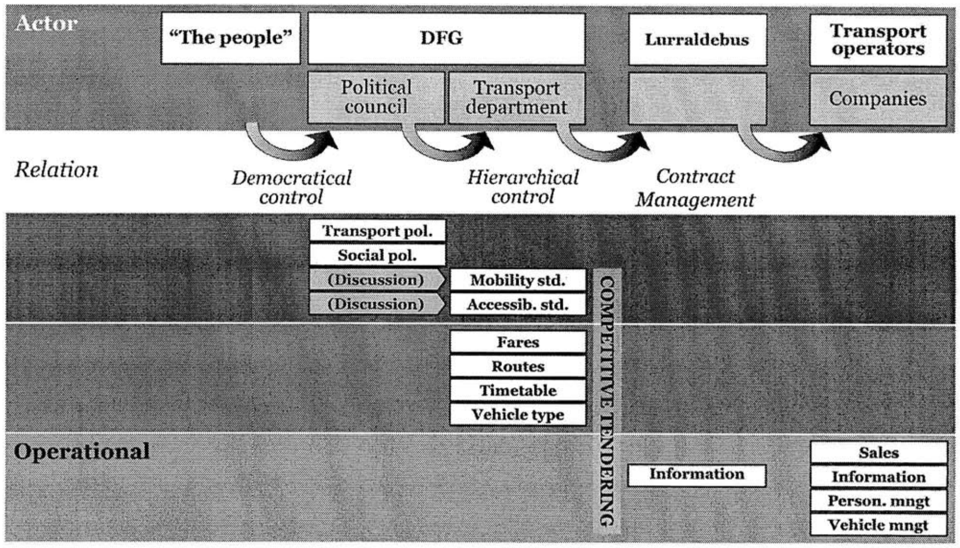

Figure 4.2: Interurban Bus Transport in Gipuzkoa after the creation of Lurraldebus.

The first step in assuming further responsibility was the re-negotiation of the contract with the largest single interurban bus operator in Gipuzkoa, Trasportes PESA. The system of passenger fare discounts has changed the structure and amount of fare revenue and resulted in the reduction of income related to the concession, and changed the basis of payment from a guaranteed income to that of an audited per-kilometer cost (with an additional amount included for profit). To ease modifications in service, the number of bus-km of service specified within the contract can now be modified without negotiation within a range of ±12% by using the per-km cost. To provide a reasonable profit for the operator, 7% of collected revenue is added to the monthly payments derived from the audited cost model. This is considered to be a model for future contracts, and various elements of this contract will be analyzed both in this chapter and the following chapter.

4.2 The Donostialdea-Este Contract

As the current set of concessions begin to end in 2012, the DFG is planning to implement major changes to the contract structure for interurban bus services within the province. The first concession under consideration is the Donostialdea-Este concession, which covers the area between Donostia and the French Border– the towns of Hondarribia, Irún, Oiartzun, Errenteria, Lezo, Pasaia and local interurban service between these towns and Donostia. (See Figure 4.3) This area includes a number of transport lines within the Lurraldebus system, has the greatest concentration of population (and vehicle traffic) in the province and a wide variety of economic activities. With stated policy goals of increasing mode share on public transport, this geographic area provides a strategic opportunity for the DFG to implement best practices in transport quality management and modal integration.

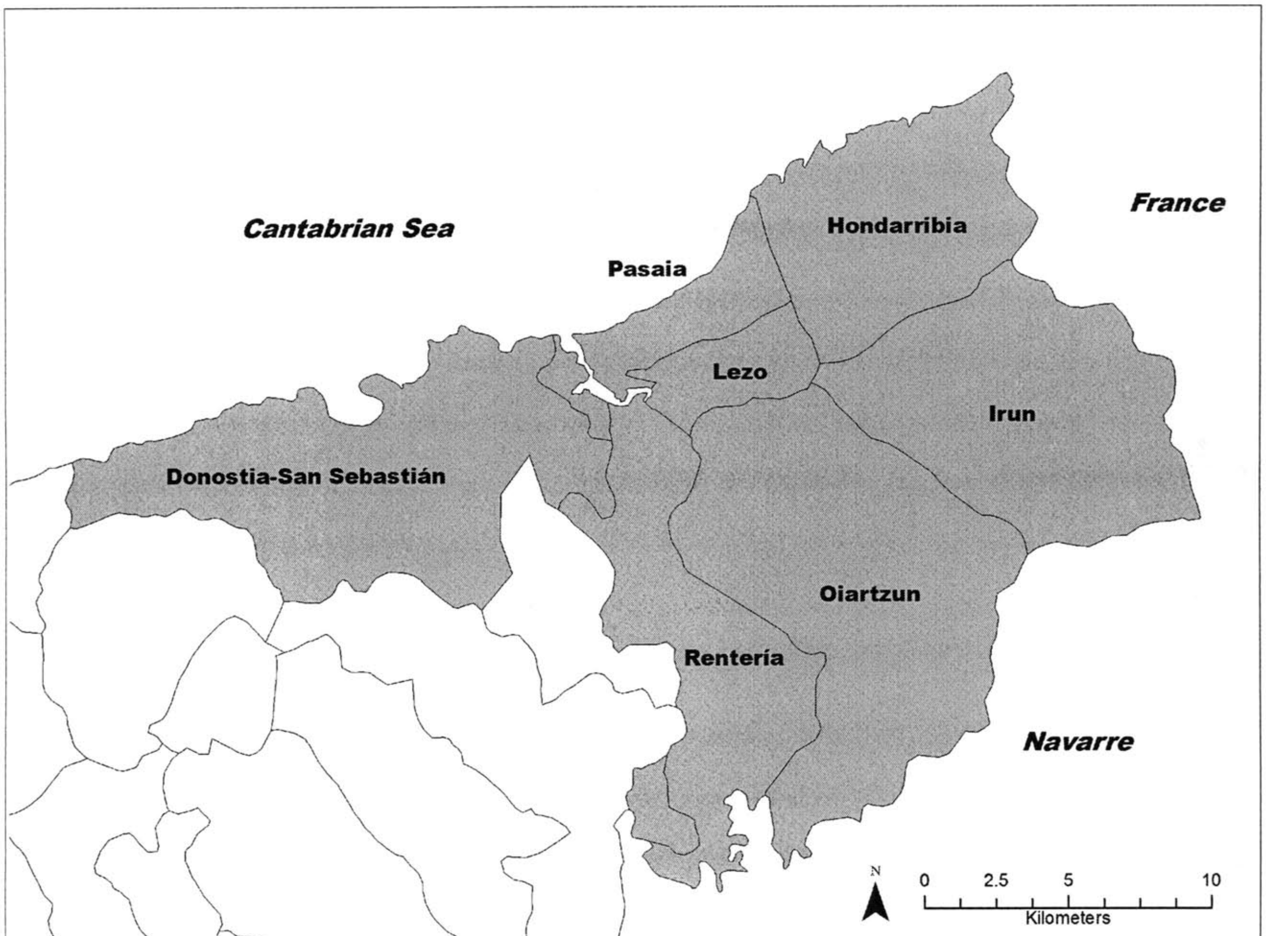

Figure 4.3: Map of Donostialdea-Este area

The area has a range of existing public transport services: two rail operators, RENFE and EuskoTren; four interurban bus operators; several municipal bus services (in Irún, Errenteria, and Donostia) and a large number of taxis. For this reason, coordination and integration among both the bus operators and the various modes[1] is fundamental to success. Under the proposed re-organization, the four concessions united under the Lurraldebus brand currently active in this area will be reorganized into one contract. Through this process, there will be an update of the services offered, including services along several trunks with short headways, and branches from those trunks that operate with less frequent service.

Ridership on the Lurraldebus network within this area has been continually increasing since the introduction of fare discounts (Figure 4.4), from 6.6 million in 2008 to 6.9 million in 2009. In the first 4 months of 2010, ridership was up an additional 5% over the same period in 2009. The total 2009 ridership of the routes in the concession (Table 4.1) accounted for approximately one third of the total system ridership.

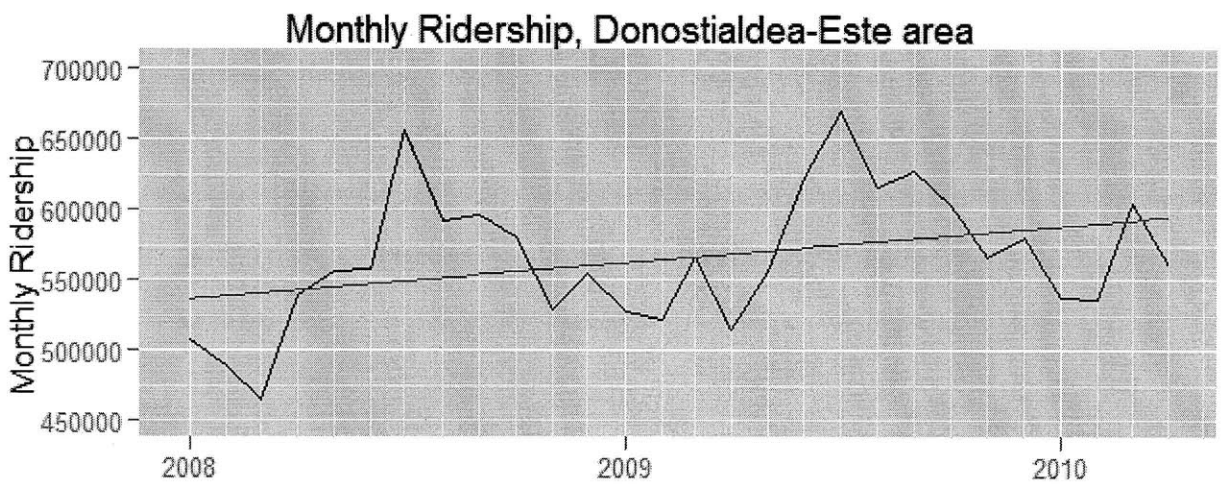

Figure 4.4 Monthly Ridership, Donostialdea-Este routes. Blue line shows a normalized trend.

1 As stated previously, this thesis focuses solely on the Lurraldebus System. Multi-modal integration is considered further in Gomez Gelvez (2010).

Route	Current Peak Period Headway	Average Weekday Ridership (Apr 2009)	2009 Ridership
A-2 Pasai San Pedro-Donostia/San Sebastian	15	2,335	917,076
A-20 San Pedro-Donostia Zona Alta Trintxerpe	40	282	102,479
A-3 Beraun-Donostia/San Sebastian	12	2,593	1,035,952
A-3 Beraun-Donostia Night Owl	60	144	21,382
A-5 Stadium	NA	--	210
A1 - Irun - Hondarribia	12	2,125	884,053
A5 - Hondarribia - Txingudi	60	556	172,997
A7 - Night Owl	60	480	28,166
I1 - Hondarribia-Irún-Errenteria-Pasaia-Donostia	30	2,088	821,201
I2 - Hondarribia-Donostia (Express)	60	317	121,756
I5 - Hondarribia-Donostia (Stadium)	NA	--	1,802
H1 - Pasai Donibane-Donostia	20	2,841	1,139,136
H2 - Oiartzun-Donostia	20	3,359	1,358,468
H3 - Oiartzun-Donostia (Express)	NA[2]	75	16,313
H5 - Stadium	NA	--	8,211
H6 - Errenteria-Hospitales	30	1,179	286,734
H7 - Night Owl	30	708	56,094
Total		**19,082**	**6,972,030**

Table 4.1: Routes involved in the Donostiadea-Este contract

4.2.1 Objectives

Among the stated objectives of the new Donostialdea-Este contract are:

Improving service management. Service management will be more effective under one operator within this physical area rather than four independent ones. Resource requirements (particularly the number of buses and support staff) are also expected to be lower under one operator.

Reorganization of offerings. There will be an improvement to the network of services provided that facilitates connections between the communities involved. This process requires an improvement of coordination with other public transport operators in the region, including the urban bus and commuter rail services.

2 One scheduled trip daily.

> **Regulation and monitoring of the existing service.** It is necessary to establish a regulatory framework for modifications to the existing service. Since beginning the current concessions there have been many changes that have impacted trip patterns.
> **Increasing public transport mode share**. Finally, it is important to realize that this is the area of Gipuzkoa with the greatest urbanization and through which a great volume of both commercial and passenger traffic passes though. Strengthening the presence of intercity public transport, as opposed to the increase of low-occupancy vehicle motorized mobility, should be considered alongside the other measures being undertaken by other public organizations. (Diputación Foral de Gipuzkoa 2008, 7 author's translation)

These objectives will be addressed in the proposed bidding and performance regime in the following sections.

Put succinctly, the goal for this reorganized concession is to provide a service which satisfies a (growing) number of users, gaining mode share by the carrot and not the stick-- increasing ridership through improved quality and levels of service. The major competition for operators providing service is not really with other public transport modes or operators, but with the private automobile. In heavily-congested areas (such as the one under consideration), a high quality public transport service can be the most practical and cost-effective way to reduce congestion and other external impacts without a reduction in overall accessibility and mobility (OGM s.a. 1998, 154).

4.3 Proposed Bidding Regime– Contract Structure

This section covers several key features of the proposed Donostialdea-Este contract and subsequent contracts. The first topic, contract duration, briefly examines the tradeoffs made when choosing the initial length of a contract period. The second section addresses the suggested practice of including scheduling details, specifically vehicle run times, in the contract in order to provide bidders with more information upon which to base their costs. The third section concludes the chapter with a proposed bid model, where bidders would specify their bid amounts by the completion of supplied spreadsheet templates.

4.3.1 Contract Duration

The draft Donostiadea-Este contract document suggests a ten-year contract term. This is the maximum term allowed in the European Public Service Obligation Regulation (PSOR, summarized in Section 2.3.1). Longer contract durations are typically offered when there the operator is undertaking substantial risk and/or substantial investment in the project. This is not the case with the Donostialdea-Este contract– most of the routes are established and currently operators can amortize a substantial portion of the cost of their vehicles over a shorter duration. Specifying the maximum allowable duration of ten years both ties the DFG to one particular operator for a length of time and negates the possibility for an extension to be offered as a contract incentive. There have been positive experiences with contract extensions as incentives in London, Stockholm, and other major authorities such as the MBTA in Massachusetts (Halvorsen 1993, 131), as they allow for additional flexibility in the contract terms and the possibility of increased competition. If tied to performance measures, contract extensions promote maintenance of service quality throughout the life of the contract as the operator continues to attempt to meet the standards.

Furthermore, the construction of a high-speed rail (HSR) network in the Basque Country this decade will surely alter the travel patterns in the area. Although many specifics are uncertain, the interurban bus routes are likely to act as feeders to the rail network. The introduction of HSR presents another major set of changes to travel patterns within the area which may or may not be served well by the proposed service. A shorter contract duration would allow for greater flexibility to respond to the changes that occur on the part of the DFG. Thus, it is suggested that the initial contract duration be five to six years, with the potential for a two to three year extension given the completion of contractual duties with satisfactory performance.

4.3.2 Inclusion of scheduling details

Lurraldebus has at its core an integrated fare collection and Automatic Vehicle Location (AVL) system implemented by consultants involved in the project. This system can provide invaluable data for the planning and operations of services involved, specifically the actual distributions of vehicle running times that can be used to develop vehicle schedules. Using these data, basic timetables and proposed vehicle schedules that reflect the operational realities of the routes involved should be developed by the DFG and provided to all prospective bidders[3]. The bidders would then be able to review and propose any improvements to these schedules as part of their bid packages.

This inclusion is desirable on several important accounts. First, according to the theories of contract economics, additional information provided to bidders reduces the degree of uncertainty in bids and therefore reduces price. Second, the process of schedule creation provides authorities an additional insight into some of the actual requirements and pitfalls of providing the desired services.

4.3.3 Current and Proposed Cost Model[4]

In order to provide estimations of the costs incurred in providing a service or changes in service, transport authorities typically employ cost models. Typically, cost models are concerned with the marginal costs of changes; as many costs are discrete (one cannot buy half a bus), the makeup of public transport costs can be "lumpy." The complexity of the models can be varied, from models that allocate all of the costs of service to one component (such as service hours or service-km), to models which attempt to fully allocate the costs of providing the service, factoring in elements categorized under capital costs – (vehicles, facilities, etc.) and various forms of operating costs (labor, fuel, administration, etc). Oftentimes cost models are used in the bidding process, and also to calculate payment amounts for contracted service under the gross cost contract model.

The DFG is currently using a model developed by a consultant that was created prior to the unification of services under the Lurraldebus brand. This model is based upon:

3 Appendix A contains a summary of the recommended schedule cycle times by time of day for the Donostiadea-Este area routes that were derived from archived AVL data.

4 Based upon (Attanucci and Wilson 2009)

Personnel costs: Costs of personnel assigned to the operation of each route-- direct personnel (drivers) and indirect personnel (ticket vendors, supervisors, security, etc)
Vehicles: Acquisition and amortization costs are taken into account
Operating Costs: Fuel, maintenance, tires, insurance, administration, etc.

These costs are then allocated to the routes based on service-km (material costs) and service-hours (personnel costs). The costs were then aggregated into a single figure, the cost per km, as shown in the equation:

$$Cost\ Per\ Km\ ,\ per\ route = \frac{Total\ cost\ assigned\ to\ route}{Total\ Km}$$

Equation 4.1, Current Lurraldebus Cost Model.

This model does not take into account the fact that service hours are the greatest portion of service cost; in the case of the costs for several operators analyzed in this research, approximately 50% of total costs are driver wages and benefits. Vehicle operations and maintenance (per-km expenses) typically account for 20-30% of costs, and fixed costs typically make up the remainder (15-25%) of total costs. This audited model and its resulting cost per kilometer is the basis for the updated contract with Trasportes PESA.

The specification of a cost model that relies on a cost per-km basis was not only a result of a desire for simplicity; it was born out of the DFG's lack of accurate information regarding service hours prior the introduction of AVL systems. This allows for calculation of the necessary inputs for a more representative model that can distinguish between the fixed and variable costs for providing Lurraldebus service.

The model proposed for calculating the costs of service modifications takes into account the "lumpiness" in service cost by separating total costs into components that are fixed (i.e. cost of garages, vehicles), semi-fixed (i.e. costs for administration), and variable (i.e. driver labor costs and benefits, fuel). Under this model, bidders would fill one template (similar to Table 4.1) with fixed and variable costs to price the desired level of service. Costs for extra service not requiring the addition of new vehicles can be estimated using the variable costs defined, and negotiations for the cost of service requiring additional vehicles can be accomplished more easily with an understanding of the fixed costs involved.

The desired results from this new bid model are a clearer definition of costs, less need for re-negotiation when changing service levels, an easier expansion (or contraction) of service, and lower costs for additional off-peak service. Factoring variable costs and amortization, service reductions can be accomplished without undue financial impact to the operator. Finally, an allocated model can provide options for calculating contract payment in the event of a force majeure event (see Section 4.3.4) by paying solely for the fixed costs of scheduled service during a force majeure event.

Cells that are shaded acknowledge either the fixed or variable nature of that particular cost of service attribute. While the template may at first seem onerous to complete, one of the points of this model is for bidders to show that they have done the necessary calculations for staff and vehicle requirements, and finally calculate a total cost for providing the service. Through the process of calculating the individual costs involved in providing service, bidders both gain additional knowledge in what is required to provide the service, and provides the authority additional information on the actual costs of providing service. Furthermore, once a library of previous bids has been established the good bids can be separated from the inadequate ones based upon experience. Eventually, the DFG will be able to prepare a "shadow bid," which can be used to reject bids that are clearly infeasible.

The template can be divided into three sections. The first is concerned with wages and benefits, where the bidder would first specify the individual costs per employee, then the number of employees proposed. Bidders would then determine what the fixed amount of supervisory staff for a bare minimum of service and a variable amount of staff necessary for the proposed level of service. Note that this section of the template could be expanded and duplicated to account for full-time and part-time employees with the average wages for part-time workers based upon the average proposed work hours.

Item	Yearly Cost per unit	Fixed Number Required for Proposed Service	Variable Number Required for Proposed Service	Fixed Cost for Proposed Level Of Service	Variable Cost for Proposed Level of Service	Total Cost for Proposed Level of Service
Wages and Benefits						
Driver Wages	37,675		150		5,651,250	5,651,250
Supervisor Wages	57,000	2	2	114,000	114,000	228,000
Mechanic Wages	40,500	4	6	162,000	243,000	405,000
Administrative Wages	32,000	2	1	64,000	32,000	96,000
Other Support Labor Wages	30,000	1	3	30,000	90,000	120,000
Benefits	8,000	9	162	72,000	1,296,000	1,368,000
Costs per vehicle						
Number of Vehicles			70			
Non-subsidized Amortization	25,000			1,750,000		1,750,000
Insurance	5,000			350,000		350,000
Equipment Rent / Leasing Costs	3,000			210,000		210,000
Service Vehicles	10,000	1		10,000		10,000
Consumables and Costs of Service						
Fuel					706,406	706,406
Tolls					5,000	5,000
Other Consumables (parts, etc)				40,000	10,000	50,000
Facility Costs						
Rent / Leasing Costs				80,000		80,000
Utilities				5,000		5,000
Insurance				10,000		10,000
Total						11,044,656

Table 4.1: Sample bidder cost template. NB: Numbers for display only

y

The second section concerns costs per vehicle. In this section, the yearly cost per vehicle is specified, then the bidder would propose the number of vehicles required for service, taking into account the maximum specified to run the service (plus needed spares), and if they believe possible, offering a number smaller than that defined. The impulse to reduce this number too far would be balanced by operators not being rewarded for and poor on time performance and payment deductions for missed trips (see Chapter 6).

The third and final section includes the costs of consumables and facility costs. Consumables such as fuel, tires, and oil are purely variable costs, as they vary with the amount of delivered service. Facilities costs – garages and other infrastructure can be considered fixed, so long as additional service does not require an expansion of garage capacity. As the costs can be large, any increase in service requiring more garage capacity would trigger a re-negotiation in contract terms.

4.3.4 Handling Eventualities: Force Majeure Clauses

When potential bonuses are a substantial and a significant percentage of an operator's profit, situations will exist when penalties would not apply. For weather-related delays and other major service interruptions, transport contracts typically include provisions for "force majeure" events (also referred to as act of god clauses). In these cases, the authority will not count the operator's performance against any incentive calculations and may pay a reduced price for the service that did not run – e.g in the case of incidents outside the operator's control paying the operator's fixed costs attributable to vehicle-km, while not paying the variable component of costs.

5 The Proposed Performance Regime

This chapter discusses how the DFG can adopt best practices in transport contracts an incentive and quality regime structures to accomplish its specific objectives. Using the eight categories of service measures proposed under EN 13816 (Section 2.5.3) a series of metrics are proposed. Through analysis of these measures provides two critical functions in the management of future Lurraldebus contracts. First, over duration of the contracts, monitoring of certain key service attributes such as travel time and maximum passenger loads provide data for modification of schedules and capacity in accordance with the limits set forth in the contract. Second, in the long term, critically measuring additional attributes helps build institutional capacity for management and development of the performance and incentive regimes for future contracts.

5.1 Important considerations in defining a performance regime

Blakey cited several goals in the creation of a performance regime for contracted public transit. A successful performance regime covers all of the following characteristics:

- Motivates good performance regardless of deviation from expected circumstances;
- Avoids the need to renegotiate annual targets and payment amounts;
- Aligns interests of the authority and the concessionaire;
- Encourages qualified operators to compete for the tender; and
- Minimizes cost to the public authority. (Blakey 2006, 70)

These goals, along with the four objectives of the Donostiadea-Este contract (Section 4.2) and Osborne and Gaebler's focus on measuring outcomes, not outputs (Section 2.4) were taken into consideration in the performance regime presented in the following sections.

Proper management of transport service does not only include incentives. Following the lessons of Osborne and Gaebler, you can't manage what you can't measure. A performance regime must compel operators to provide adequate high-quality service for the customers by specifying a small range of measures. Some of these may be directly linked to payments (see Chapter 6), while most are designed for measurement to effectively manage service delivery. These measures and incentives should cover the targeted and delivered sections of the quality loop (Section 2.4.2) in order to focus the efforts of the operator on improving overall quality, rather than just one or the two quality elements to the detriment of others.

5.2 The Benefits of Simplicity

When designing a performance regime, simplicity should be a fundamental objective. A properly designed, simple regime is easier to manage for both the authority and the operator; it also focuses both parties on delivering the highest quality service to customers, not on the minutiae of contract language. Especially when making the transition to contracts including incentive regimes, the initial contract should remain simple while institutional capacity regarding contract management is developed. The inconclusive experience with incentive contracts in Stockholm, where a total of six indicators were included in the first performance regime and their relation to payment was determined in an ad hoc manner, may be an example of an overly complicated initial contract failing to show the intended results. London's highly developed performance and incentive regime has evolved over more than two decades of regulated competition and a great deal of institutional capacity has been developed around monitoring and updating the indicators and benchmarks involved; it is not suggested than any authority undertake such an ambitious regime in their first incentive contract.

5.3 Elements of the Proposed Performance Regime

This section proposes suggestions for quality measures that would be included in a quality management framework. The suggestions are organized under the framework adopted by EN 13816 (Section 2.4), dividing quality measures into eight categories for understanding targeted and delivered quality. The measures proposed are divided into measures that are performed at a route level, as well as measures that are designed to be measured at an aggregate system-wide or area-wide level. Specific measures are suggested based upon a combination of the author's understanding of the challenges that face the Lurraldebus system and balancing simplicity and ease of data collection. In addition to directly-collected performance measures, this performance regime relies on measures that are collected with mystery shoppers (see Sections 2.5.3, 3.3.3). In order to aggregate this information in a simple, cohesive fashion, a "scorecard" is proposed. The scorecard model is discussed further in section 5.4.

Should other measures be desired, a wide variety of additional measures can be found in Annex A of EN 13816 (CEN 2002), and TCRP reports 88 and 100 (Kittleson & Associates 2003a; Kittleson & Associates 2003b) .

5.3.1 Availability

Availability measures are defined as the extent of the service offered in multiple dimensions– in geography, time and frequency. If a potential passenger does not find that the availability of the public transport network meets their expectations, they will not voluntarily choose to make trips via public transport. A well-designed transport network matches targeted availability with the general population's expected availability through defined service standards and policies.

Frequency / Headway

The amount of service provided at various times of the day and week is a crucial factor in determining if a person decides to make a trip on public transport. Some potential passengers may not ride a service at one frequency, while a slight increase in frequency may convince them to use the service more often. For example, in a comprehensive multiple-year calculation of elasticities for various regions in Spain, de Rus (1990) calculated a service elasticity for urban buses is Donostia-San Sebastián of 1.06, meaning that for every 10% increase in service-km (or number of trips on a given route) during the time period, ridership increased by 10.6%.

Operating Hours

Like frequency, operating hours are a crucial factor in choosing to make a trip via public transport. If service does not run during the time one desires to travel, making that trip via public transport is not an option. Furthermore, shorter operating hours may affect the total number of trips taken throughout the day. For example, an office worker who finds peak service attractive, but occasionally works later than the end of service might discount the possibility of making regular work trips on public transport. By providing service later into the evening, public transport becomes an option for that person for a higher percentage of their trips.

An operating hours metric would take into account the total number of hours that a route or stop has service per day. This figure would then be integrated in the route's scorecard.

Load Factors / Crowding

Capacity, both theoretical and perceived directly impacts service availability. If a passenger perceives that a vehicle is full when it arrives at a stop, service is unavailable and the effective service frequency is reduced as they will be forced to wait for the next vehicle. Lack of space for wheelchairs and the disabled is another crucial aspect of service. Experienced loads are also related to the passenger's comfort level of the in-vehicle portion of a trip, reflected by the ability to find a seat and by overall crowding levels. From the authority perspective, passenger loads are often used to specify service frequency or vehicle size – regular loads over a defined policy threshold usually imply a necessity to increase capacity (Kittleson & Associates 2003b, 3-43; Fijalkowski 2010). High loads and passenger crowding also slow service speed and decrease reliability by increasing dwell times at stops (Milkovits 2008).

The Lurraldebus system can measure loads on buses to a high degree of accuracy due to the of fare validation technology and policy in place; when both boarding and alighting, passengers validate their cards against a reader. This provides a level of loading for each stop along each trip which can then be aggregated and monitored. A graphic representation of the distribution of loads for one route in the Donostialdea-Este area is presented in Figure 5.1. Horizontal lines were plotted for the approximate number of seats (31) and a proposed maximum load standard the number of seats plus 50% in standees (46)[1].

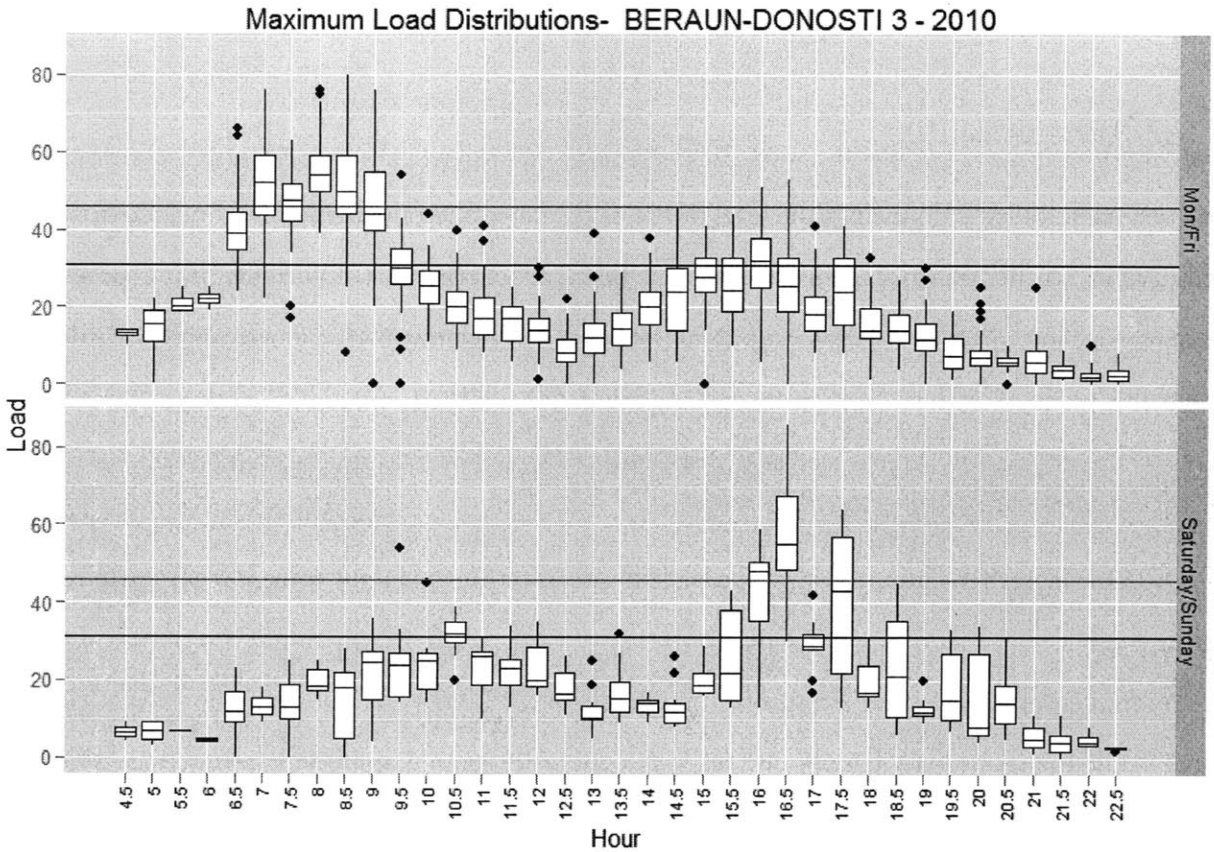

Figure 5.1: Loads by Half-Hour, Beraun- Donostia March 2010

For the route in question, it is apparent that almost all trips during the weekday morning peak, as well as a number of trips during early afternoons during the weekend exhibit loads over seated capacity. If possible, it may be advantageous to add some service during these times. Numerically, a total of 10% of all trips and 61% of weekday morning peak trips were above the load standard defined above.

1 Based upon approximate interior dimensions of the Mercedes Benz Citaro 12m bus, this number would result in an approximate area of .3m^2 (3.3 ft^2) per passenger, within the range of a typical maximum scheduled load (Kittleson & Associates 2003b, 3-45).

It may be decided that loads such as these are acceptable and there is no need for action at this time. Given the constant increase in ridership on the Lurraldebus network, however, excessive passenger crowding may become a problem needing remediation in the future. As the Lurraldebus fare collection system aggregates these data automatically, the cost of monitoring is very low and it is suggested that this be included in a monitoring regime.

5.3.2 Accessibility

Accessibility is defined as the level of access to the public transport system including the interface with other transport modes. Like availability, accessibility is a crucial factor in a potential passenger's choice in making trips via public transport– if the network is not accessible according to a person's expected quality, a potential passenger will not use it.

Walk / access distance to network

One factor recognized as part of a person's decision to use public transport for a trip relates to the presence or absence of service near both the trip origin and destination. Often, the most common method of accessing a transport network is by walking from an origin point to the nearest stop. While the results vary based upon walking conditions (topography, pedestrian environment), a variety of studies done in North American cities show that 75 to 80% of passengers will walk approximately 400m or less to board a bus (Kittleson & Associates 2003b, 3-9). Targets reflect this distance and are typically defined as a percentage of population that fall within a specific radius of a stop; e.g. Brisbane, Australia specifies a goal of 90% of the total population being less than 400 m from an origin to a public transport service stop (Murray 2001).

Ease of transfers and multi-modal integration

Another key aspect of service accessibility is the ease of transfers between vehicles, be they between different routes, networks or modes. In an analysis of multi-modal integration in Gipuzkoa, Gomez Gelvez (2010) proposed a series of improvements that aim to improve connectivity between the various public transport networks (rail, urban and interurban buses).

One of these measures is the schedule coordination among modes. As the characteristics (frequency and reliability of each mode or route, area amenities, etc) of a transfer vary from transfer point to transfer point, some transfers can be very difficult for a passenger to make, discouraging trips using this transfer. When analyzing transfer coordination across networks, Crockett (2002) defined four levels of quality of information provided in planning trips that involve a transfer and their influence on the customer perspective (Figure 5.1).

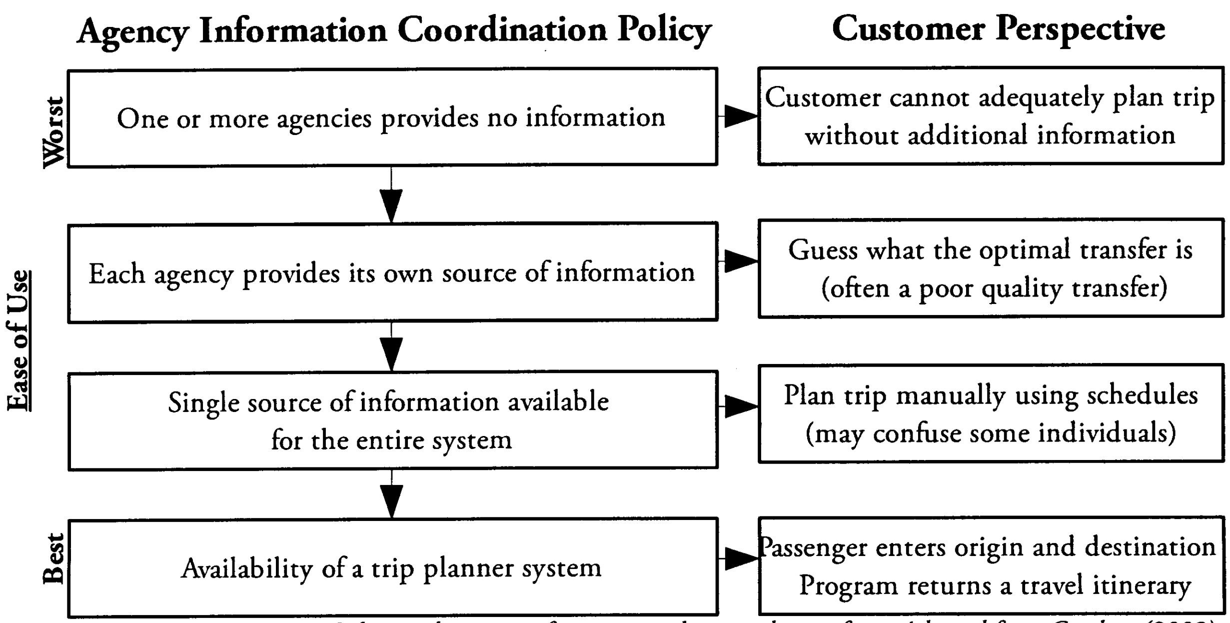

Figure 5.2:Relations between information policies and ease of use. Adapted from Crockett (2002)

A possible measure using this framework is calculating the number of passenger trips that occur at each of the levels of coordination, aiming to bring all trips taken under the fourth level. For example, as Lurraldebus maintains a single source of information for the entire system,100% of trips currently made wholly on the Lurraldebus network fall under the third level. All trips that are taken involving a modal transfer or a transfer from urban to interurban bus would fall under the second level.

Another measure of connectivity is the ability to use the Billete Único smart card as a method of payment across all modes. As the card is accepted on DonostiaBus and planned to be accepted on rail services, the number of transfer trips per month would be calculated and monitored. The overall health of the multi-modal transport network can be measured by the movement in this measure.

5.3.3 Information

Information relates directly to the provision of knowledge about a transport system to assist the planning and execution of trip. Passengers need information on the accessibility and availability attributes of a service. Without information, potential passengers will not be able to use the service, even if it is a potential option for their trip. Tourists, infrequent passengers, and new residents benefit the most from receiving information on service, although they can be the most difficult to reach with information. Regular users count on system information for planning as well, when making a decision about making a trip to a new destination. Thus, any quality regime should measure the availability of information to passengers and potential passengers alike.

Information on Schedules

Many of the Lurraldebus routes provide only a schedule with a departure time for each trip (Figure 5.3). In the course of this research, an analysis of AVL data was performed in order to determine the approximate time it takes for a bus to travel from the terminal to each stop during different times of the day and days of the week. This information could then be combined with the departure times to provide a highly-detailed schedule for use in a trip planner. For a schedule designed for presentation directly to the public, passing times for selection of key stops would be included. Figure 5.4 is an example of a suggested schedule format. Providing this information is a crucial for passengers who are unfamiliar with the trip they are considering.


A2

loturak/ correspondencias

L1 L2 L2A I1 A1 A3

EuskoTren

ordutegia/ horario		1go IRTEERA 1ª SALIDA	AZKENA ÚLTIMA	MAIZ. FREC.
ASTL.-LAR. LUN.-SÁB.	HONDARRIBIA	08:25		
		09:35	17:35	60′
		18:55	21:55	
	TXINGUDI	10:05	17:05	60′
		18:25	22:25	

LARUNBATA: Txingudiko lehen zerbitzua 09:05ean izango da. / SÁBADO: el primer servicio de Txingudi será a las 09:05.

Figure 5.3: Schedule, route Hondarribia – Txinguidi. Schedule displays only departures from terminals and frequency.

ZUMAIA	GETARIA	ZARAUTZ	ORIO	USURBIL	URBIL	DONOSTIA
	6:35	6:45	6:55	7:05		7:30
	7:05	7:15	7:25	7:35		8:00
7:00	7:10	7:15	→ Autopista →			7:45
	7:35	7:45	7:55	8:05		8:30
7:30	7:40	7:45	→ Autopista →			8:15
	8:05	8:15	8:25	8:35		9:00
8:00	8:10	8:15	→ Autopista →			8:45
8:30	8:40	8:45	→ Autopista →			9:15

Figure 5.4: Schedule, route Zumaia - Donostia. Displays passing times for towns along the route.

In order to measure this attribute of service, a percentage of routes with adequate schedules would be calculated. The targeted percentage, is 100% of routes covered with more detailed schedules.

Percentage of Stops Displaying Schedule Information

After passenger-friendly schedules have been developed, there should be an effort to place these in publicly visible spaces, specifically stops. While it may seem logical to place schedule information only at stops with frequent service and a large number of passenger boardings, at other stops with lower frequencies this information may be even more critical. As low-frequency routes do not offer "turn-up-and-go" service where one can arrive and expect a bus momentarily, waiting time is even more crucial at these stops. The percentage of stops displaying schedule information would be included as a measure in the system-wide scorecard.

Percentage of stops displaying real-time arrival information

A feature of the Lurraldebus system is real-time information displays, where estimated arrival times are calculated using AVL information. Real-time information adds significant value to services that have low frequency or are unreliable. If a bus does not arrive on schedule, passengers are informed of this fact automatically.

Policies for information under abnormal conditions

In the case of service interruptions, operators should develop a process for relaying information to customers. Recent developments in information technology such as Twitter[2] and real-time information displays allow for operators to broadcast information to passengers quickly and at very low cost. While this is not a numeric measure, it is suggested that the DFG and each operator develop a standard communication

5.3.4 Time

The time aspect of performance measurement is simply measures related to the amount of time required to make a trip. Various perspectives are considered in the following measures, including analysis of both average and extreme values of trip time, and the comparison to the primary alternative mode-- the automobile.

Overall Expected Travel Time

Overall expected travel time includes the access time from one's origin to a stop, the waiting time for a transit vehicle, in-vehicle travel time, egress time from the alighting stop to the final destination, and any time required for transfers between routes or modes during the trip. Calculation of access and egress times are typically assumed to be 2 to 3 minutes (based on a maximum 5-minute walk time to a bus stop). In-vehicle travel times can be calculated using AVL or card transactions, and transfer times can be calculated for card transactions by computing the difference between alighting and subsequent boardings[3]. For inclusion in a measuring scheme, it is suggested that a

2 Public transport agencies large and small, such as the Municipal Transportation Authorities of New York and San Francisco are now using Twitter, a service that enables its users to send and read short messages, to broadcast incident reports, delays, and construction announcements.

3 In his thesis, Gomez Gelvez (2010) presents an analysis of transfer time between interurban and urban services.

number of top origin-destination pairs for each route be analyzed. A sample calculation for Overall Travel Time for one route is presented in Table 5.1. By critically analyzing this information, areas for improvements in service or infrastructure can be identified.

Time Period	Headway	Estimated Average Access Time (min)	Estimated Wait Times (min)[4]	Median In-Vehicle Travel Time (min)	Total Travel Time
05:30-6:59	30	3	5	27	35
07:00-9:00	12	3	7	35	45
09:00-12:30	15	3	9	31	43
12:30-14:30	12	3	7	32	42
14:30-20:45	15	3	7	29	39
20:45-22:45	30	3	5	29	37

Table 5.1: Overall Travel Time, Route Beraun - Donostia Weekdays, Feb 2010

On-Time Performance

Numerous metrics are present within the quality literature for measuring service reliability in passenger service. Quite possibly the most common measure of reliability in public transport is on-time performance (OTP), which is calculated at the percentage of buses that arrive or depart a certain point within a window of time (commonly between one to zero minutes early and three to five minutes late).

Table 5.2 shows a subset of the routes involved in the Donostiadea-Este contract and their deviation from scheduled departure time, and presents several interesting elements. First, it appears that most of the routes are departing more than one minute late. This is likely due to the recording

4 For headways of greater than 15 minutes, it was assumed that passengers would arrive in relation to the schedule, or 5 minutes early. For passengers during peak times, it was assumed that passengers randomly arrive and average wait times were calculated using distributions of actual and scheduled headways.

of a departure condition when the bus leaves a 100m radius from the stop; not directly upon the instant of the driver shutting the door and pulling away from the stop. Thus, the departure times contain a degree of error and can be considered precise, although not highly accurate. For this reason it is suggested that calculations of on-time percentage count departures less than two minutes[5] greater than the scheduled departure as "on-time," and any early departure (noted below as a negative number) should not be considered as on time. This percentage of departures could either be a single value for the entire contract, or calculated at the route level based upon conditions around the terminal stops.

5 In cases where a terminal stop is placed directly before a stoplight. Should the bus' scheduled departure occur during the beginning of a red phase, it may take two minutes for light to turn green, allowing the bus to proceed and cross the 100m threshold.

Route/ Direction	Peak Period Headway	Number Observed	Median Deviation from Scheduled Departure	Standard Deviation
a3 - HONDARRIBIA-IRUN	12	108	1.58	2.42
A5 - HONDARRIBIA-TXINGUDI	60	129	1.48	9.88
A5 - TXINGUDI-HONDARRIBIA	60	136	1.48	5.39
BERAUN-DONOSTI	12	509	-5.43	65.32
DONOSTI-BERAUN	12	618	1.6	22.2
DONOSTI-PASAI SAN PEDRO	15	619	1.7	11.21
H1 - DONOSTIA-PASAI DONIBANE	20	460	1.1	1.4
H2 - DONOSTIA-OIARTZUN (MATTEO)	20	341	1.23	3.09
H2 - DONOSTIA-OIARTZUN (MENDIN)	20	135	0.93	1.3
H6 - ERRENTERIA-HOSPITALES	30	181	-4.22	3.76
H6 - HOSPITALES-ERRENTERIA	30	211	1.48	2.47
i1 - DONOSTIA-HONDARRIBIA	30	325	1.3	1.93
i1 - HONDARRIBIA-DONOSTIA	30	213	1.3	4.49
i2 - DONOSTIA-HONDARRIBIA	60	126	1.72	1.71
i2 - HONDARRIBIA-DONOSTIA	60	163	1.98	4.72
BERAUN - DONOSTI (Stadium)	NA	1	-3.88	NA
DONOSTI - BERAUN (Stadium)	NA	1	13.48	NA
DONOSTI - PASAI SAN PEDRO (Stadium)	NA	2	10.14	3.03
PASAI SAN PEDRO - DONOSTI (Stadium)	NA	3	1.1	0.27

Table 5.2: Deviation of departure times (in minutes) from scheduled departures for selected routes. Weekdays, March 2010.

One troubling observation is that several routes (most notably Beraun- Donosti) appear to be regularly leaving their terminal early, as is shown by negative values for the median deviation from scheduled departure. It is possible that there is a conflict in schedule data between the Lurraldebus system and the schedule which is given to the driver. If this is the case, it would need to be corrected before the implementation of the performance regime. If buses are actually departing early, placing an incentive on on-time departures will compel the operator to improve performance provided the incentive is reasonable (see Chapter 6). Finally, it is evident that in the small sample available, routes serving the stadium for football matches may depart late. This is to be expected, as match end times are variable. For this reason, special service should not be counted in on-time performance figures.

To estimate grades for on-time performance, a Level of Service (LOS) model was used (Table 5.3). This model grades on time performance based upon the percentage of observations within the range specified.

LOS	On-Time Percentage	Comments
A	95.0-100.0%	1 late transit vehicle every 2 weeks (no transfer)
B	90.0-94.9%	1 late transit vehicle every week (no transfer)
C	85.0-89.9%	3 late transit vehicles every 2 weeks (no transfer)
D	80.0-84.9%	2 late transit vehicles every week (no transfer)
E	75.0-79.9%	1 late transit vehicle every day (with a transfer)
F	<75.0%	1 late transit vehicle at least daily (with a transfer)

Table 5.3: Levels of Service for On-Time performance (Kittleson & Associates 2003b, 3-47)

Using data from March 2010, levels of service were calculated using this methodology for the zero to five minute deviations from scheduled departure, as shown in Table 5.4.

Route/ Direction	LOS 0-5 min
A3 - HONDARRIBIA-IRUN	B
A5 - HONDARRIBIA-TXINGUDI	C
A5 - TXINGUDI-HONDARRIBIA	B
BERAUN-DONOSTI	F
DONOSTI-BERAUN	A
DONOSTI-PASAI SAN PEDRO	A
H2 - DONOSTIA-OIARTZUN (MENDIN)	A
H2 - DONOSTIA-OIARTZUN (MATTEO)	A
H6 – ERRENTERIA-HOSPITAL	F
H6 – HOSPITAL-ERRENTERIA	B
I1 - DONOSTIA-HONDARRIBIA	B
I1 - HONDARRIBIA-DONOSTIA	A
I2 - DONOSTIA-HONDARRIBIA	A
I2 - HONDARRIBIA-DONOSTIA	F

Table 5.4: LOS grades for departure times on a selection of routes within the Donostialdea-Este concession, March 2010

At the 0-5 minute level six routes out of the fourteen above maintain LOS A, while four maintain LOS B. More worrisome are those four routes (Hondarribia – Txinguidi, Beraun- Donosti, Errenteria- Hospital, and Hondarribia – Donostia) that maintain service below LOS C. Again, this may be a result of incorrect schedule data and merits further attention.

It is important to analyze the circumstances of these routes and, if necessary, take corrective action. Poor performance with regards to departure times may be a result of not having enough scheduled running time to reach the terminal without departing late. Instances of this form of unreliability would be mitigated by providing sufficient run time for 95% of buses to reach their terminals in time for the next departure, as described in Section 4.3.2 . Should the these deviations from schedule be a result of a lack of supervision (in the words of Osborne and Gaebler, you can't manage what you can't measure), placing monetary incentives (see Section 6.2) on improving OTP to LOS A at the 0-5 minute level for all of the routes involved will most likely compel operators into making the necessary improvements.

Ratio of Auto vs Public Transport Time

To gain new riders, travel time by public transport has to be competitive with the private automobile for that particular trip. For this reason, the ratio of travel times between auto and public transport between the most common origins and destinations should be calculated. This presents a clear picture on areas that may need additional focus and/or improvements. In general, any ratio above 2.5 – 3.0 probably indicates that it will be difficult to attract passengers to such services.

An analysis of the ratio between the different modes can take two forms. First, the ratio can be considered from terminal to terminal. In order to illustrate this measure, auto travel times were estimated using information from Google Maps[6]. Public Transport travel times were calculated using AVL data from February, 2010.

Route	Direct Auto Distance (km)	Auto Travel Time	Mean PT Travel Time (Weekday 9am - 2pm)	Ratio
Hondarribia - Donostia	20	28	56	2
Oiartzun - Donostia	12	23	40	1.7
Pasai San Pedro - Donostia	5	10	21	2.1

Table 5.5: Sample comparison between auto and public transport travel time

The other methodology is to analyze the top five to 10 of origin-destination (OD) pairs by ridership. Below, one example using the OD pair with the highest ridership on the route Beraun- Donostia:

From Stop	To Stop	Ridership (April 2010)	Direct Auto Distance (km)	Auto Travel Time	Mean PT Travel Time (Weekday 9am - 2pm)	Ratio
Galtzaraborda, 52 (Errenteria)	Hotel Maria Cristina (Donostia)	2911	7.5	14	29	2.07

Table 5.6: Sample comparison between auto and public transport time on major OD pair

6 It was assumed that times calculated in this process were not realistic under rush hour conditions, and thus a comparison was done to midday travel times via public transport. More accurate methods of auto travel time measurement are suggested.

Reliability Buffer Time

Another time-focused reliability metric, Reliability Buffer Time (RBT), was devised to capture the effects of unreliability by estimating the amount of time passengers are required to allocate in order to complete a journey by a desired time with high probability. RBT was analyzed by Uniman (2009) in the context of the London Underground and Ehrlich (2010) in the context of London Buses.

The concept of reliability buffer time (RBT) is defined as the "difference between an upper percentile, N, and an intermediate or lower percentile, M, and this value is defined as the additional 'buffer' time that would be required of passengers in order to be N-percent sure of on-time arrival at their destination" (Uniman 2009, 71). RBT compliments measures of waiting in that it accounts for the variability in total travel time by factoring in in-vehicle travel time (IVTT). This is calculated per origin-destination (O-D) pair, time interval (e.g. AM peak), and sample period.

$$RBT = (N^{th}\ percentile\ travel\ time - M^{th}\ percentile\ travel\ time)_{O-D\ pair,\ Time\ Interval,\ Sample\ Period}$$

Equation 5.1: Reliability Buffer Time

For this analysis, the upper percentile was defined as the 95th percentile, and the intermediate percentile was defined as the 50th percentile. For a person taking regular weekday trips via public transport, this roughly equates to a delay once per month. RBT can be analyzed using data from the Lurraldebus AVL system, which when combined with a reliable schedule can provide insights into customer experiences with the Lurraldebus system. Unfortunately, without published schedules, these can only be calculated for departure times. With the creation of schedules including timepoints beyond the departure, calculation of RBT will be possible for points further along the route.

Using the difference between actual and scheduled departure time data, RBT was calculated for the departure terminals of two routes chosen for their difference in length. For the calculation of the travel-time components of RBT, it was assumed that passengers began their trip at the departure terminal and reached their destination at the last stop. While this is not the most common origin-destination pair, it demonstrates the process of calculation for RBT. In the absence of timepoints after the departure and a scheduled trip time, the median running time for the time period was used.

Travel Time components of Reliability Buffer Time at 95th percentile. AM Peak, February 2010			
Route	**Route Distance (km)**	**Median In-Vehicle Travel Time (minutes)**	**RBT (minutes)**
Hondarribia – Donostia	24	56	8.1
Donostia - Oiartzun	12	35.4	5.7

Table 5.7: RBT (Travel time only) on two routes in the Donostialdea-Este area

Like the ratio of auto versus public transport time, RBT could also be calculated using major origin-destination pairs. Analysis of the most traveled OD Pair, on the Beraun – Donostia route is presented below.

From Stop	To Stop	Distance	Median In-Vehicle Travel Time (minutes)	RBT (minutes)
Galtzaraborda, 52 (Errenteria)	Hotel Maria Cristina (Donostia)	7.5	25	12

Table 5.8: Reliability Buffer Time, AM Peak. April 2010.

This particular OD pair shows a greater amount of RBT than either of the routes studied above. It indicates that passengers boarding at this stop must allow for 12 extra minutes in order to be assured that they will reach their destinations on time. As this distance between these stops encompasses most of the route length (the final stop is the terminus), it also indicates that the other passengers boarding this route are incurring similar numbers.

5.3.5 Customer care

Customer care aspects refer to service elements that match the current service with the needs of individual customers. These aspects cover less tangible elements than those proposed above and require the use of mystery shoppers in their measurement. Measuring these elements regularly and reviewing the results with operators can aid their focus in improving customer quality, especially in the presence of a ridership-based incentive as presented in Chapter 6.

Staff / Driver Behavior

Operator staff– specifically drivers– are regularly interacting with customers. Two crucial aspects of driver quality are behavior and driving skills. Through monitoring driver interactions with passengers using mystery shopper surveys, an agency gains an additional perspective into what is occurring in regular service. When tied with driver of the month honors (see below) and feedback provided to the operator, staff behavior standards encourage professionalism.

Driver of the Month Honors

It is common for operators to offer drivers token honors, either in the form of small rewards (such as pins, patches, plaques, rings, gold watches, dinner certificates), monetary bonuses (survey responses show that US transport agencies offer awards as high as $1,500 for 35 years of safe driving with zero preventable accidents), recognition in company publications, and Driver-of-the-Month or Driver-of-the-Year awards (King 1996, 11). The reason for such honors is to offer a small reward to the driver for good, safe, and courteous performance. If part of an effective safety improvement program, the monetary costs of these rewards is far lower than the costs of accidents, which can run into the thousands of Euros. These rewards also present an opportunity for sharing of potential operator contract payment incentives discussed in Chapter 6. One London Bus operator's internal publication includes a monthly section of positive comments, a selection from which is reprinted below

This issue's ***Star Person is Teddy Palmer of King's Cross*** *who received this s****uperb commendation from a member of TfL Customer Research*** *for his professionalism...*
I was traveling on a bus on Friday and was so impressed by the driver's calm professionalism that I wanted to tell you about it and ask you to pass on my thanks to him via his garage.
The good things he did:

- *Said 'thank you' to me as I pressed my Oyster card on the reader*
- *Drove carefully and smoothly throughout, moving off and braking gently*
- *Served all the stops perfectly, drawing up to the curb each time so it was easy for everyone to sit down safely before moving off*
- *Was patient and helpful with a big crowd of tourists who weren't sure about ticketing and didn't know where they were going*
- *Kept his cool despite dealing with a very crowded bus at several points; he had to ask a passenger to keep the front part of the bus clear for health and safety reasons, and did so professionally. Even though the passenger was not particularly pleasant about it, when he did move, the driver thanked him for doing so*
- *Kept his cool despite being aggressively cut up by another bus at Marble Arch*

I would be grateful if you could pass on my commendation to him.
R Snow, TfL Customer Research (Metlife 2009)

While the benefits may not be directly quantifiable, driver-of-the-month honors certainly improve goodwill between the operator and their drivers. Their implementation is relatively low cost in comparison to the value safety and quality enhancements received in return.

5.3.6 Comfort

Another customer desire is comfort, the service elements involved in making trips relatively comfortable. Using mystery shoppers, relative levels of passenger comfort can be compared from operator to operator.

Driver quality

As with driver behavior, driver quality would be addressed in a mystery shopper survey, which asks several questions regarding driver attitude, acceleration, braking, and cornering. The objectives of measurement are to:

- Improve and increase the general awareness of road safety,
    - Reduce the number of passenger, pedestrian and road accidents,
    - Contribute to an overall reduction in insurance claims and premiums,
    - Stimulate driver awareness of driving and road safety issues and the effect these have on customer service, and
    - Identify and specify the driver training needs of organizations and individuals. (Driving Standards Agency n.d.)

After collecting and aggregating the scores, these data could then be used in consultation with operators, suggesting which areas are in need of improvement.

Vehicle cleanliness

Another important aspect of passenger comfort is vehicle cleanliness. Mystery shoppers typically use a scorecard sheet such as that in Table 5.9. In this model, each quality aspect has a number of sub-values, which add to 100 (a perfect score). These aspects are then assigned a weight, or a percentage of the overall quality total that the aspect is deemed to represent. Scores are calculated by multiplying aspect weights by the total from each aspect, and summing of all of the resulted sub-scores.

Item	**Value**	**Aspect Weight**	**Example Score**
Aspect: **Smell**	100		100
Organic smells (vomit, urine, faeces, sweat)	43		
Smell of tobacco	19		-19
Smell of fuel	20		-20
Stuffy or musty smell	18		
Aspect Subtotal		0.2	0.2 x 61 = **12.2**
Aspect: **External cleanliness**	100		100
Dirty body, advertising panels, lateral line panels	13		
Traces of diesel leak near stopper	37		-37
Outside of windows dirty	19		
Traces of diesel fumes or soot	31		
Aspect Subtotal		0.1	0.1 x 63 = **6.3**
Aspect: **Internal cleanliness**	100		100
Presence of garbage on the floor	15		
Presence of vomit	18		
Greasy, slippery or sticky floor	17		
Inside of windows dirty, greasy but not scratched	9		
Inside panels spoiled, tagged, torn	5		
Dirty handrail or handles	11		
Dirty or dusty driver's cab	4		
Dirty seats or rotunda	17		
Aspect Subtotal		0.4	0.4 x 96 = **38.4**
Aspect: **External visual aspect**	100		100
Damaged parts of body or lighting out-of-order	26		
Torn doors or vestibule joints	37		
Outside door opening command out-of-order	37		
Aspect Subtotal		0.1	0.1 x 100 = **10**
Aspect: **Internal visual aspect**	100		100
Undulating floor, deteriorated step	32		
Handrail, guardrail or handles broken, or unusable	13		
Difficult door opening	16		-16
Passengers seats torn to shreds, burnt, or damaged	16		
Inside of windows or protection windows scratched	7		
Aspect Subtotal		0.2	0.2 x 84 = **16.8**
Total Score			**83.7**

Table 5.9: Sample Mystery Shopper Scorecard: Vehicle Cleanliness (CEN 2006)

Stop Cleanliness / Amenities

Like vehicle cleanliness, stop cleanliness is another important aspect in customer comfort measured using Mystery Shoppers. A Scorecard for stop cleanliness shares many of the same aspects as the vehicle cleanliness measures, specifically excluding the vehicle-specific measures and including further measures such as the conditions of stop information – conditions of route signs, schedules, and real-time displays (if applicable).

5.3.7 Safety and Security

Safety and Security measures concern the sense of personal protection experienced by customers using the service. Psychological factors, such as fear or stress related to making a trip may inhibit trips via public transport that meet expected quality in all of the other factors.

Accident Rates Related to Service

The number of accidents related to bus operations can be measured in a form of accidents per 10,000 or 100,000 km of service. It is often broken down into categories such as accidents involving minor property damage (€1000 or less), major property damage, injuries, and deaths, as well as accidents involving only passenger (trips, falls, etc.).

Crime Rates Related to Service

The number of crimes aboard a network can be measured in a form of crimes per 10,000 or 100,000 km of service. It is often broken down into categories such as crimes against passengers, crimes against staff, and crimes against property.

5.3.8 Environmental Impact

All forms of mobility have an impact on the environment. Environmental impact measurements focus on the effect on the environment resulting from the provision of service.

Passengers transported per fuel consumption unit

Measuring the efficiency of transport, both between modes and in relation to itself, may be worthwhile for both management and publicity. A USA-based freight railroad's publicity campaign includes the statement "Trains can move a ton of freight up to 436 miles on a single gallon of fuel" (CSX 2010). The natural question to ask is: what number of passenger (or passenger-km) does Lurraldebus move per unit of fuel? Although the calculation of this figure would require information additional information from operators, it is believed that this information should be easily available.

Waste management policies

Adherence to environmental management standards is becoming more common among European Transport operators. A common recognition of best practices is the ISO 14001 certification, which specifies generic requirements and guidelines for an organization to

- Identify and control the **environmental impact** of its activities, products or services, and to
- **Improve** its environmental performance continually, and to
- Implement a **systematic approach** to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved. (ISO)

A simple yes or no scorecard measure would take this into account-- has each operator obtained ISO 14001 certification?

5.3.9 Other Performance Measures

In a well-rounded performance regime, not all metrics must take the individual customer into direct perspective. Other measures aid the authority to manage service at a aggregate level, yet do not fall under the categories defined above. The following measures are common measures that authorities implement as methods of benchmarking one route against another.

Productivity

Productivity is defined as the ratio of total passengers transported divided by the total service hours provided during a given period. This number will vary by route, as it is affected by demand and speed characteristics.

Cost-Effectiveness

Cost-effectiveness is defined as ability to meet the demand for transit services given existing resources. It shows the ability of a transport network to perform its core functions: transporting passengers in a cost-effective fashion. Common measures of cost-effectiveness include the farebox recovery ratio, which is the ratio that fare income covers the costs of providing service and cost-per-passenger, which allocates total costs assigned to a route and then divides this by its ridership. Using 2008 data, cost-per-passenger were calculated for the routes involved in the Donostiadea-Este contract, as shown in Table 5.10:

Route	Route Type	Cost / Rider 2008
Oiartzun-Donostia por Autopista	Express	€4.36
Hondarribia - Donostia A-8	Express	€2.98
Trinxerpe alto	Local	€3.06
Irun-Hondarribia	Local	€1.17
Hondarribia-Centro comercial Txingudi	Local	€1.26
Errenteria-Hospitales	Local	€1.43
Beraun-Donostia	Trunk	€1.01
Pasai San Pedro-Donostia	Trunk	€0.82
Donibane-Donostia (H1)	Trunk	€0.80
Oiartzun-Donostia por N1	Trunk	€0.92
Hondarribia-Donostia N-1	Trunk	€1.39

Table 5.10: Cost-per-Passenger, 2008

Ridership

Each route, in the course of service, attracts a number of riders. Ridership levels may vary from year to year, and are representative of a number of factors – area characteristics (primarily job and housing density), route characteristics (frequencies, reliability), and economic conditions. As discussed in Chapter 6, the level of ridership per route is suggested as the basis of an operator incentive included in future contracts.

5.4 The Operator Scorecard

In order to integrate the measures proposed into a cohesive visual presentation, generating a "scorecard" for each operator and their routes is proposed. The scorecard includes one row for each measure selected for inclusion the performance regime, including the target, the previous year's and current year's performance, and if there is a positive or negative trend. An example scorecard is presented in Table 5.11. In addition being broken down by route, aggregated one-page versions could present information for each operator and the entire network as a whole.

Date	May 2010
Operator	X
Route	Y
Operating Hours	05:00- 24:00

Measure	**Previous Year's Score**	**Current Score**	**Goal**	**Goal Met**	**Trend**
Incentives					
Ridership	80000	82000	NA	Yes	+
On-Time Performance	98.00%	98.50%	99%%	No	+
Trips Delivered	99.00%	98.50%	100.00%	No	-
Percentage of Trips Exceeding Load Standard					
Of All Service	7.00%	5.00%	5.00%	Yes	+
During Peak Hours	40.00%	45.00%	25.00%	Yes	-
For Most Common OD Pair:	Point A to Point B				
Ratio of PT / Auto travel Time, Peak Direction, Peak Period	2	1.8	2	Yes	+
Reliability Buffer Time	35	37	35	No	-

Table 5.11: Example route scorecard

6 The Proposed Incentive Regime

As discussed in Chapter 2, the theories of contract economics show that public transport operators holding contracts where payments are not tied to performance have little or no incentive to maintain consistently good service quality. For this reason, public transport operations contracts typically include incentives directly related to performance. Experience with incentive contracts has generally been positive, as is shown in the case studies presented in Chapter 3. It is recommended that the DFG, or any organization drafting operations contracts include several incentives in its future concession contracts. The incentives proposed – ridership, reliability, and completed service– are intended to be supplemented by a larger range of metrics employed as part of a management regime (Chapter 5).

6.1 Ridership

One of the common pitfalls in a gross-cost contracting regime is that operators are not directly encouraged to maintain quality performance as they are not sharing revenue risk– i.e., receiving a portion of the revenue from fares. For this reason, incentive contracts often rely upon a patronage incentive, based upon either revenue or ridership. These two types of incentives have the advantages of :

- Focusing the concessionaire on the central mission of any transit service, attracting riders who will regularly use that service;
- Balancing the natural inclination of any concessionaire holding a gross cost contract to focus on reducing the costs of the service and only those specific performance measures to which incentives and penalties have been attached;
- Providing a meaningful incentive for all of the intangible or difficult to measure factors which a concessionaire must demonstrate to attract new riders and revenue;
- Establishing a true "gain-sharing" cooperative spirit within the contractual framework which may attract more quality bidders. (Blakey 2006, 96-97)

Why would an organization select one form of patronage incentive over the other? Revenue incentives are typically offered in cases where there is little variability in fare types or categories (when most riders are paying the same fare), an authority wants to discourage fare evasion or ticketless travel, and ridership counts are difficult to obtain. One clear advantage for certain types of revenue incentives is that when payments are set to increase as revenue increases over a projected level– i.e. the incentive "pays for itself," revenues over projections will be shared with the operator without additional cost to the authority.

Ridership incentives are typically offered when there is a range of fare types, especially if certain riders have highly-discounted or free tickets. The Lurraldebus fare policy is complex; with seven zones, three levels of (relatively steep) discounts for those who pay by smartcard, different fares for cash transactions and night-owl service, and a wide variety of additional discounts and concessions for youth, seniors, etc. The complex fare policy makes an incentive based upon ridership both easier to calculate and easier to understand for the parties involved.

One further question to consider is if all routes receive the same bonus per passenger regardless of the routes' characteristics? The Lurraldebus network has a wide variety of routes with varying lengths, vehicle requirements, ridership and speed. Generally, routes can be grouped into two categories: primary, (or trunk, with high ridership and short headways, typically running through a dense area), and secondary, (or feeder, with lower ridership and longer headways). Table 6.1 is an example of the revenue differences that can occur between the two types of route and shows that route ridership in Gipuzkoa can vary by an order of magnitude.

Route	Type	Average Weekday Ridership (Apr 2009)
Pasai San Pedro-Donostia/San Sebastian	Primary	2,335
San Pedro (Zona Alta Trintxerpe)-Donostia	Secondary	282

Table 6.1: Example Ridership by type of route

The difference between these two types of routes raises several questions. First, is there a difference in the cost required to gain one additional rider on the different route types? Also, with only an incentive on ridership, would an operator focus reliability improvements solely on trunk routes where additional riders can be considered "low-hanging fruit," leaving service quality on feeder routes unimproved? It is possible to propose a formula for calculating economically optimal incentives based upon the relationship between route characteristics, ridership, the operator's willingness to pay, and cost[1]. Given the desire to focus on simplicity for this first generation of incentive contracts in Gipuzkoa, however, the answer to this question may be using a simple bonus per passenger over a specific benchmark for each route and relying on other performance incentives to spur quality improvements among all routes.

Ridership incentives, like other performance-based incentives, can be broken down into two general types: super-incentives, which link payments to the operator to incremental ridership gains (e.g. an additional €1 per passenger over a threshold); or target-linked incentives, which links payment of specific bonuses to the realization of a ridership target (e.g. a bonus of 5% of contract value for a ridership gain of over 10%) (Inno-V et al. 2008a, 73-74). As the Lurraldebus ridership numbers are calculated using reliable automatic fare collection data, it is preferable in this case to offer a bonus per additional passenger over a baseline "floor–" a minimum number of passengers necessary to earn any bonus. The floor would be defined at or slightly below the level of ridership. By setting the floor below the current level, the operator is compelled to work hard to maintain existing ridership levels, even in the face of temporary economic downturns. Additionally, to prevent windfall profits a "ceiling," or maximum bonus per year can be set. The ceiling can either be a maximum percentage gain in ridership on a route, or a maximum payment for the entire contract.

1 Larsen (2001) analyzed a similar scheme utilized in incentive contracts in the Hordaland region of Norway, calculating different incentive amounts based upon the marginal cost per additional passenger for 3 types of passengers: passengers in peak periods on routes that have capacities defined by demand and not strictly by minimum-headway policy, other passengers in peak periods, and passengers in off-peak periods. For three out of the four operators studied, the marginal cost of each additional passenger was higher in the first category, while the lowest cost was in the second category. This model could be extended to place varying incentives on these various types of routes, although it is complex to understand and calculate and thus not proposed at the moment.

In order to provide this incentive in relation to the revenue collected from each additional passenger (and thus offset the cost by increased performance), the bonus would be offered as a percentage of the average fare. Given the differences in fares between cash and smart cards, this information was calculated (Table 6.2) for the various types of fare payment for the month of April 2010 in the Donostialdea-Este area.

Method of Payment	Percent of Boardings	Average Fare
Card	75.7%	€ 0.74
Cash	24.3%	€ 1.41
Card And Cash	100.0%	€ 0.90

Table 6.2: Average fare by method of payment Donostialdea-Este routes, April 2010

Using various percentages of the average fare and a benchmark floor equal to 95% of the previous year's ridership, sample bonus calculations for were performed for the proposed ridership incentive (Table 6.3), using data from April 2009 and April 2010. For the first two calculations, the per-passenger bonus was set at 30% and 50% of the average card fare. In the third calculation, a bonus value of 50% of card fare and ceiling of 125% of 2009 ridership was applied.

Route	2009 Ridership	2010 Ridership	Bonus = 30% Avg. fare	Bonus = 50% Avg. Fare	Bonus = 50% Avg. + 25 % Ceiling
Oiartzun – Donostia	100,676	108,443	€2,842	€4,736	€4,736
San Pedro - Donostia	77,743	82,308	€1,876	€3,127	€3,127
Trintxerpe – Donostia	8,933	13,980	€1,220	€2,033	€826

Table 6.3: Example ridership bonus calculation

All three of the routes presented had ridership gains of differing magnitudes. While Oiartzun – Donostia saw the greatest increase in number of passengers (and hence the largest bonus), the largest percentage gain (56%) was on the Trintxerpe – Donostia route. Without the presence of a ceiling, this gain would be result in over-rewarding the operator for performance that is likely not to be a result of improvements in service quality.

Basing a ridership incentive on the previous years figures is a simple method that works given constant levels of service for both the route and the network. Should levels of service, fare agreements, or economic conditions change, the DFG should reserve the right to modify the benchmark figures within reason. For small changes, adjustments may be based upon elasticities calculated for the specific area (e.g. the Lurraldebus-specific zonal fare elasticities calculated in Gomez Gelvez (2010) or the urban bus elasticities for Donostia presented in de Rus (1990)). In the case of major changes, estimating changes in demand may require the use of more elaborate network models.

One final context-specific recommendation involves the competition between urban and interurban buses in the city of Donostia- San Sebastián[2]. As some routes entering the city share a both a corridor and stops with urban buses and the interurban trips have a lower fare, some passengers prefer to take interurban routes for trips wholly within the urban area. This has a negative impact on both the revenues of the urban operator and on the operational performance of the interurban buses, specifically an increase in running times due to a greater number of stops made and increased passenger loads. To prevent operators from "poaching" additional urban passengers to gain the bonus it is suggested that bonuses not be offered for new passengers whose trips that fall wholly within the urban zone. This restriction is easily tracked with data from the automated fare collection system, which maintains boarding and alighting stop information. If new service integration agreements between Lurraldebus and other operators are subsequently agreed upon, flexibility should be built into the operator contracts to modify the basis for the ridership bonus.

2 For furthermore information on the relationship between Lurraldebus and Donostiabus, see Gomez Gelvez (2010).

6.2 Reliability

Another common incentive in transport contracts relates to reliability. As was discussed in Section 5.3.4, there are various measures of reliability, some of which are regularly tied to payment. These include excess wait time (EWT, incentivized in London and introduced in Section 3.3.3), reliability buffer time (RBT), and on-time performance (OTP).

While EWT can be preferable to OTP in terms of maintaining a customer focus, it is more appropriate for high-frequency service (with headways of 10-12 minutes or less). RBT, also a customer-focused metric, requires a high degree of confidence with the schedule for all stops beyond the terminal for its calculation. For many of the routes involved, a published schedule for stops after the departure terminal does not yet exist, and several revisions to the schedule may be necessary to obtain a level of confidence whereby a bonus could be calculated based upon a robust schedule. Furthermore, the results of the proposed changes to the trunk of the Donostialdea-Este corridor calling for schedule coordination between the routes in the Donostiadea-Este corridor are uncertain; each route is subject to different conditions before joining the trunk, and once reaching the trunk the results of interaction between the routes involved are uncertain. Until schedules are fine-tuned over several periods, EWT or RBT cannot be accurately estimated for stops after the terminal. Thus, values for RBT should be measured, but not incentivized and the standard metric of OTP from the departure terminal only is proposed for incentives in this contract. Before defining a method to correlate payments with performance, the total amount of incentive must be decided upon. For OTP, it is suggested that a maximum bonus of 3% of the contract value be offered.

In order to tie OTP to payments, two possible methods are proposed. The first is a linear representation, where payments increase in relation to improvements. The second involves an "increasing slope," where payments for marginal improvements increase as performance approaches 100%. The increasing slope model recognizes that the marginal cost for improvement increases in a non-linear fashion as service delivery approaches 100%. In other words, the harder it is for an operator to achieve the highest performance level, the greater the rewards. Figure 6.1 shows a possible representation of the two methods.

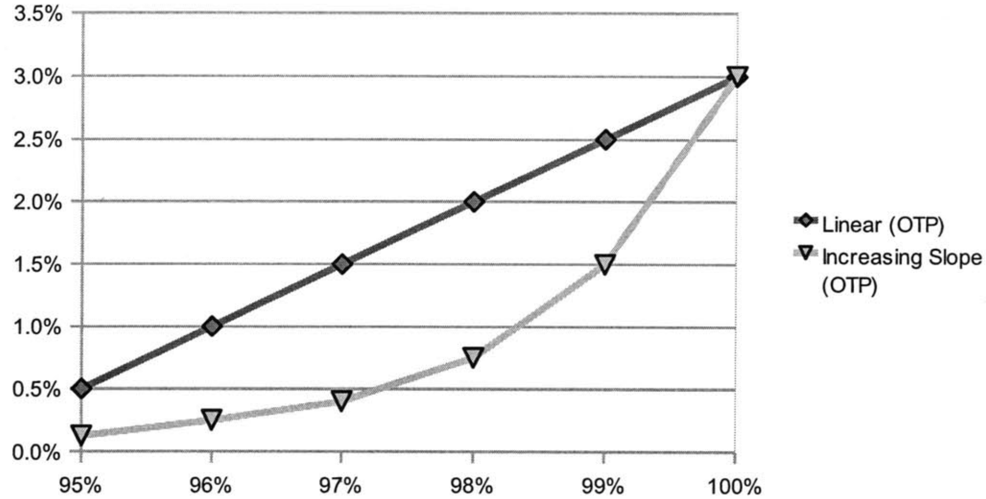

Figure 6.1: Example linear vs increasing slope payment amounts for OTP incentive

An example, considering a route value of €1,500,000 and demonstrating these two payment concepts is presented in Table 6.3.

Percentage On-Time	Linear Bonus	Linear Bonus Amount	Increasing Slope Bonus	Increasing Slope Bonus Amount
95%	0.5%	€7,500	0.10%	€1,500
96%	1.0%	€15,000	0.20%	€3,000
97%	1.5%	€22,500	0.40%	€6,000
98%	2.0%	€30,000	0.75%	€11,250
99%	2.5%	€37,500	1.50%	€22,500
100%	3.0%	€45,000	3.00%	€45,000

Table 6.4: Example payment amounts based upon on-time performance

6.3 Completed Service

It is nearly impossible for an operator to provide a full 100% of the service specified in a schedule at a reasonable cost, and a small percentage of "missed trips" (usually less than 1-3%) is to be expected in the provision of public transport service. The most common causes of missed trips are mechanical breakdowns and unexpected driver absences. When deciding how to mitigate the number of missed trips due to absence, the operator must make decisions regarding the size of the "extraboard" (number of substitute vehicle operators available), affecting how many trips are run when an unexpected absence occurs. As each additional driver assigned to the extraboard must be paid a salary; a rational profit-motivated operator will attempt to trade off the potential for unreliability with this cost. Similarly, when mitigating the number of missed trips due to breakdowns, an operator must make decisions on the ratio of spare buses available within the fleet.

Assuming that route characteristics, specifically the specified schedule, are reasonable enough so that routes can run regularly without incident, penalizing for excessive missed trips or "lost mileage" by an amount that equals or exceeds (by up to 20%) the fully allocated cost of the trip should motivate an operator to keep additional drivers or vehicles on hand to reach a desired goal of minimizing missed trips. This is especially true since the deduction for each trip would not only include the marginal driver wages and fuel, but all of the allocated fixed costs as well.

Beyond payment reductions for service not delivered, the DFG should consider an additional incentive for exceeding a percentage of service completed. When considering incentive targets for delivered service, a bonus would be offered for delivering a percentage above a predefined figure. Performance above this percentage would result in a monthly bonus paid to the operator, while every missed trip not attributable to force majeure events results in a loss of revenue for the operator.

As with the OTP incentive, the incentive amount for completed service can increase either linearly or with an increasing slope, where each marginal improvement results in a slightly greater payment. A graph of two possibilities is presented in Figure 6.2.

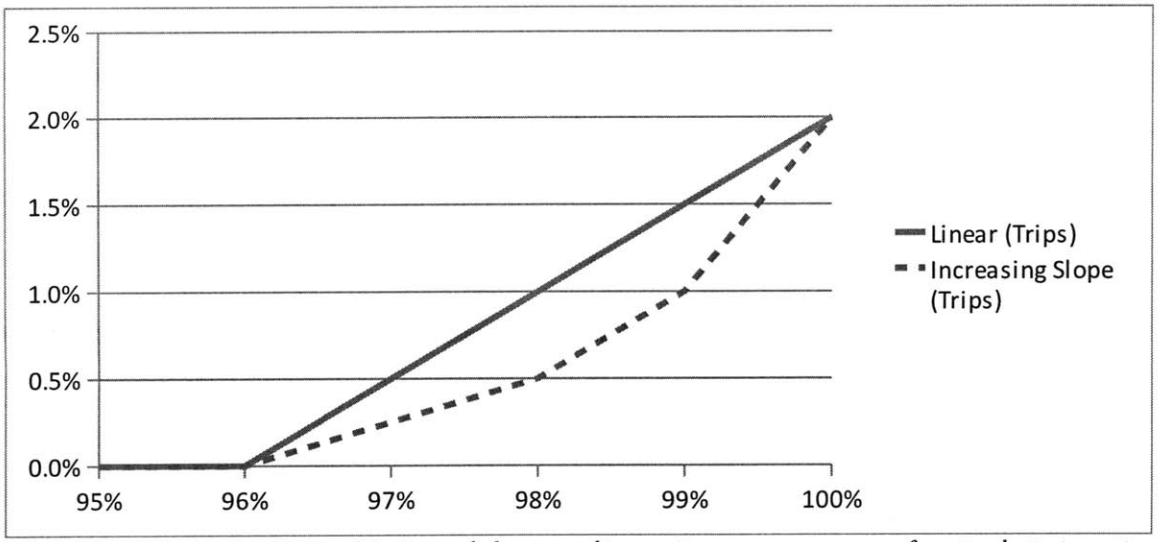

Figure 6.2: Example linear and increasing payment amounts for missed trip incentive

Assuming a route with a €1,500,000 contract value, sample payments given a certain performance are presented in Table 6.5.

Scheduled Trips Delivered	Linear Bonus	Linear Bonus Value	Increasing Slope Bonus	Increasing Slope Bonus Value
96%	0.0%	€0	0.0%	€0
97%	0.5%	€7,500	0.3%	€3,750
98%	1.0%	€15,000	0.5%	€7,500
99%	1.5%	€22,500	1.0%	€15,000
100%	2.0%	€30,000	2.0%	€30,000

Table 6.5: Example contract payment amounts for missed trips incentive

The DFG currently has the ability to monitor the percentage of missed trips and delivered km from the operator PESA under the name *Gestión Contrato Programa* (Contract Program Management, or CPM). An advantage that the CPM system has over solely using the Lurraldebus

AVL and farebox data is that it provides the operator the opportunity to prove and annotate which trips were run, but not logged due to incorrect driver logins into the automated system or equipment failure. Without these data, it is not possible to accurately estimate the current proportion of service being delivered solely from the existing automated data. It is suggested that this be rolled out as part of the new Donostiadea-Este contract and all subsequent contracts and be used as part of the basis for monthly payments to operators.

6.4 Conclusion

This chapter has introduced three incentives that are suggested for future Lurraldebus concessions. The first, calculated based upon changes in ridership, is designed to focus the operators on attracting new riders by improving overall service quality. The two additional incentives, on-time performance and an incentive for the reduction of missed trips are designed to compel the operator to maintain constant reliability, regardless of the factors that influence new ridership.

7 Conclusions and Suggestions for Further Research

This chapter includes a summary of the analysis and recommendations of this thesis, including the major features to include in designing a transport operations contract including incentives. The review of prior practice was specifically applied to the development of new public transport concession contracts for interurban bus service within the province of Gipuzkoa, Spain. Section 7.2 poses several additional questions for future research.

7.1 Summary

Open bidding of concessions contracts for public transport operations have often shown demonstrable results that competition can reduce costs for service. Recognizing that an operator will have the drive to maximize profits and minimize costs– which may result in a reduction in service quality– incentives are typically offered to achieve the policy goals of the authority instead of incorporating a myriad of rules and prohibitions into a complex contract. Although it has been shown that incentives can have a demonstrable effect on service quality, there are many lessons learned from the theory of contract economics, as well as other areas where incentive contracts have been applied. Some of these lessons are discussed below.

First, an authority interested in structuring contracts for public transport service must have a high degree of clarity in their objectives before the development of a performance regime is begun. In the process of developing a performance regime within an area, the current performance of operators in the area and objectives of perspective operators must be analyzed. These objectives are then taken into account when building the both the contract structure and performance regime.

Contract structure, when designed according to best practices, aligns the interests of both the authority and the operator and results in more effective service provision. Several aspects of transport contract structure, including contract duration, cost modeling and bid price templates were discussed, along with suggestions for the implementation in Gipuzkoa of best practices in each topic, including but not limited to:

- Requiring bidders to specify staffing plans broken down into minimum and variable staff levels for the proposed service plan;
- Specifying detailed bidding templates for the base level of service, as well as priced options for any additional service, divided into fixed and variable cost components for all categories; and
- An initial contract duration of 5-6 years, with an option for a contract extension of 2-3 years based upon performance in the initial term;

As there is a recognized relationship between measurement and management, specific measurements should focus on the deficiencies of service in the area as well as the particular aspects of service quality that the local authority values highly. For the DFG, this research is recommending a performance regime modeled on EN 13816, the European standard on quality management in public transport. Specific measures are recommended in each of the eight categories specified under EN 13816. After defining a series of measures, the authority should regularly discuss the results of these measurements with the operators in order to diagnose causes of deficient service and suggest further improvements that can be made.

Finally, it is proposed that clear improvement should be rewarded using incentives tied to measurable service performance improvements. In order to focus operators on overall quality improvements, simplicity should be the greatest concern of the incentive regime; the number of incentives should be limited so that the total value of each incentive can significantly increase the operators profit. Taking this into account, three incentives were proposed for future Lurraldebus contracts that reflect the overall delivered service quality-- one focused on increasing the level of ridership, as well as two others focused on improving reliability by placing incentives on achieving high levels of on-time performance and service delivered. Representative incentive levels and methods for calculating and paying each are proposed for an upcoming contract currently under consideration in Gipuzkoa.

7.2 Suggestions for Future Research

When implementing any incentive regime, it is important to consider the impacts of the incentives on service quality. It is believed that the incentives proposed will improve operator performance, however they have not been tested under real-world conditions and there exists a degree of uncertainty with the results. After several years of experience with Gipuzkoa's new contract model, an evaluation of the incentive regime should take place, taking into account any improvements between prior and current performance. If reliability performance has improved substantially, it may be advantageous to raise the threshold values from which a bonus is earned. If the results of improvements are inconclusive, however, several questions may be asked. First, is the amount of incentive offered in line with the operator's costs for quality improvements? Also, are the functional service planning guidelines correct? At this point, it may also be determined that other problems have arisen in service delivery which targeted performance measures and incentives would address. In order to improve the performance measures and incentives included within future contracts, transport authorities should collect and analyze data relating to the change in service levels, reliability, and ridership.

The warehousing of automatically collected data in the Lurraldebus system– specifically vehicle positions and ridership data that can be tied back to individual passengers– also presents a wide variety of additional research possibilities. The first is studying the implementation of service planning techniques for an interurban bus network such as Lurraldebus utilizing the increased level of detailed data available. Changes in the travel patterns of the area, especially with the construction of HSR may require modifications to the network, and efficient solutions to network reorganization may be developed using the Lurraldebus data.

Another suggestion involving the use of automatically collected data is the co-ordination of service along specific corridors. There are several areas where multiple routes with 20 minute or less headways overlap, creating higher service levels with frequencies that can support passengers who wish to "turn-up-and-go." In working to improved service reliability along these corridors, further research may study the interaction between routes and improved coordination and operations control techniques. The final goal would be to reduce expected waiting time for passengers along these corridors.

The final suggestion for research is an analysis of user characteristics and usage. By asking: "what factors influence ridership?" further research may attempt to understand what specific attributes have the greatest effect on ridership within Gipuzkoa. The influence of service characteristics such as frequency and crowding, as well as the Lurraldebus fare discount policy should be studied to greater detail. With greater understanding of these factors, new investments can be efficiently planned and targeted, and the goal of seeing "everyone on public transport" can be realized.

Appendix A: Analyzing Vehicle Requirements for the Donostialdea-Este Routes

Accurately estimating vehicle requirements for the interurban bus service in Gipuzkoa requires accurate information on route cycle times[1]. During this research, however, it was discovered that the Lurraldebus AVL system did not contain sufficient information to obtain accurate distributions of travel times. As the information logged within the AVL system are directly linked to the farebox and in order to sell tickets/accept fares, the driver may log out of the trip in service early to sell tickets for the upcoming trip. This results in a trip time that does not contain the arrival time at the terminal. In order to obtain travel distributions and suggested cycle times, an analysis was undertaken of the positions stored within the Lurraldebus AVL system.

In order to determine trip times for the services in the Donostialdea-Este area, software was developed using the spatial extensions present within Microsoft SQL Server 2008 in combination with R, an open-source statistical analysis programming language. This software uses two methods to determine end-to-end trip times, a simple method, and a more complex method. The simple method is used when the Lurraldebus database has a record of both a departure

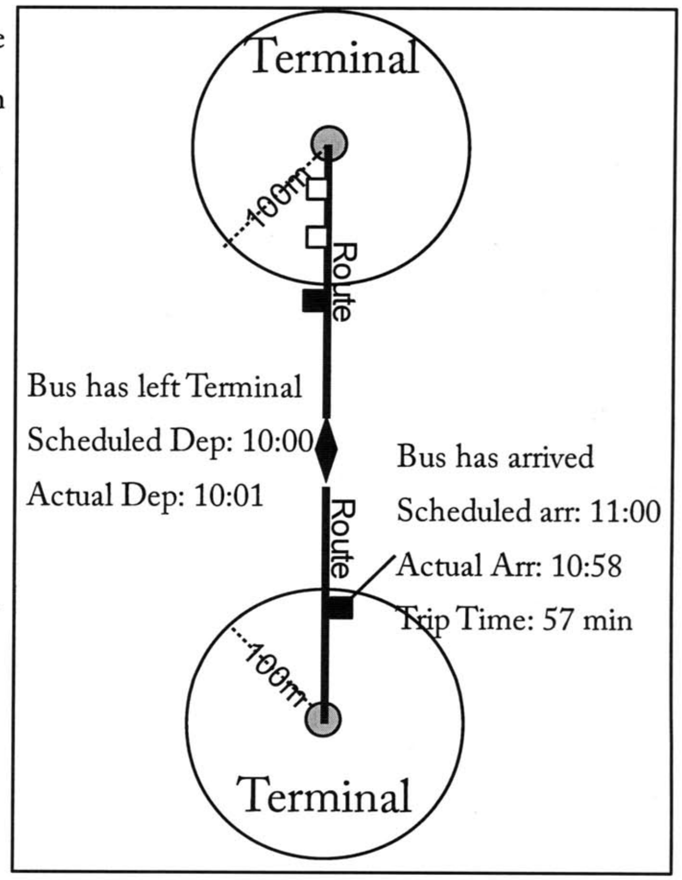

Figure 1: Complex trip-time calculation method description

1 The cycle time is the time that a bus is scheduled to complete an entire round trip of a route, calculated by combining scheduled running time and layover/recovery time.

from the origin terminal and an arrival at the destination, and calculates the time difference between them. The complex (see Figure 1)method is used when a trip has a record of the departure stop. It then proceeds to examine the positions for that bus in the next 1.5-2 hours, and finds the first position within 100m of the arrival terminal. The difference or the two times is calculated, and outliers over two times the median of the dataset were filtered out.

This software was run for the weekdays in the final two weeks of February 2008, which resulted in distributions of travel times. These distributions were then divided by time period and by hour. For the existing routes (using DFG-proposed frequency improvements when specified), the standard scheduling practice of taking the 95th percentile of trip times was used for calculating cycle times. These total cycle times were then divided by the proposed route headways in order to calculate vehicle requirements.

Without interlining[2], it was determined that the providing the service specified within the draft contract documents would require 40 buses. The total fleet among the operators in the Donostialdea-Este area is 41 buses; thus, maintaining a 40 bus operation would not provide for adequate spare vehicles necessary in cases of maintenance or accident.

Interlining was then considered. There are two clear opportunities for interlining, the first between H1 (Pasai Donibane - Donostia) and H2 (Oiartzun - Donostia). The second is a5 (Txinguidi - Hondarribia) and i2 (Hondarribia - Donostia Express). Route i1 (Hondarribia - Donostia N-1) is another candidate for interlining, although it does not fit well with the others when building a schedule manually. With scheduling software, it may be possible to find a more appropriate interlining. By performing these interlining options, as well as a slight modification of scheduled headway on route H2, the number of buses required for the proposed service drops to 37.

2 Interlining is "the use of the same vehicle operating on more than one route with the same operator, without returning to the garage during route changes. This is most often done at common terminals or for routes sharing a common trunk." (Boyle 2009, G-6)

Cycle Times: Donositaldea-Este

Bold= Different than Time Period Median, *Italic= Off-Peak Headway*

Rte	Pattern	**Current Sched Time**	**Off-Pk Hway**	**Head way**	**Req'd Bus**	Early AM	7:00	8:00	9:00	10:00	11:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	Late Eve
a3	Irun- Hondarribia / Lurgorri	25	30	**10**			26	26	26	26	26	26	26	28	27	27	35	31	31
a3	Hondarribia - Irun	25	30	**10**			24	24	24	26	26	26	26	28	26	26	27	25	25
	Total Cycle Time						*50*	50	50	52	52	52	52	56	53	53	**62**	56	*56*
	Req'd Buses				6														
	Note: Headway Reduced from 12 to 10 minutes in Anteproyecto. This change does not require another bus																		
a5	Hondarribia - Txinguidi	30		60			28	32	32	35	35	35	35	36	37	30	30	31	31
a5	TXINGUDI-HONDARRIBIA	30		60			NA	NA	31	31	31	31	31	34	35	35	45	33	33
	Total Cycle Time						NA	NA	63	66	66	66	66	70	72	65	**75**	64	64
	Req'd Buses				2														
i1	DONOSTIA-HONDARRIBIA	60		60			63	63	63	66	66	66	66	67	66	66	67	67	60
i1	HONDARRIBIA-DONOSTIA	60		60			67	67	65	65	65	65	65	**69**	67	66	64	62	60
	Total Cycle Time						130	130	128	131	131	131	131	136	**133**	132	131	129	120
	Req'd Buses				**3**														
	Note: Can do a 45 Min Headway with 3 Buses																		
i2	DONOSTIA-HONDARRIBIA (express)	45		45			51	**47**	**47**	60	60	65	45	**50**	60	48	52	38	38
i2	HONDARRIBIA-DONOSTIA (express)	45		45			34	**45**	**62**	39	39	39	39	38	**54**	**42**	35	34	
	Total Cycle Time						85	92	109	99	99	104	84	88	**114**	90	87	72	38
	Req'd Buses for Base Service				**3**														
	Note: Can interline with a5 and use 4 buses total. See table 4 for details.																		
H1	PASAI DONIBANE-DONOSTIA	30	25-30	20			*35*	**37**	34	33	33	33	33	36	37	36	36	36	*33*
H1	DONOSTIA-PASAI DONIBANE	30	25-30	20			*34*	32	31	47	47	47	47	42	47	52	47	46	*45*
	Total Cycle Time						*69*	69	65	80	80	80	80	78	**84**	**88**	**83**	**82**	*78*
	Req'd Buses for Base Service				**4**														
	Additional for Peak Service (16:00 - 19:00)				**1**														

Table 1: Calculated cycle times, Donostialdea-Este, February 2010

h2	OIARTZUN-DONOSTIA	40	30	20		39	45	45	45	45	45	45	45	31	47	47	47	*47*	*44*
h2	DONOSTIA-OIARTZUN	40	30	20		31	41	41	41	52	52	52	52	45	50	52	60	*47*	*48*
	Total Cycle Time					*70*	86	86	86	97	97	97	97	76	97	99	**107**	*94*	*92*
	Req'd Buses for Base Service				5														
	Additional for Peak Service (18:00)				1														
	Note: Also possible to not include additional bus and make headway every 25 minutes 19:00-20:00, then 30 minutes 20:00-																		
h3	OIARTZUN-DONOSTIA (express) NA								42										
h6	ERRENTERIA-HOSPITALES	30?					45	45	**40**	42	42	42	42	42	45	45	45	45	36
h6	HOSPITALES-ERRENTERIA	30?					28	28	28	30	30	30	30	30	30	30	30	33	31
	Total Cycle Time						73	73	68	72	72	72	72	72	75	75	75	**78**	67
	Req'd Buses for Base Service				**3**														
A2	PASAI SAN PEDRO-DONOSTI	30		15			27	**31**	27	24	24	24	24	24	26	26	24	22	21
A2	DONOSTI-PASAI SAN PEDRO	30		15			34	34	34	26	26	26	26	**24**	31	43	26	26	27
	Total Cycle Time						61	65	61	50	50	50	50	48	57	**69**	50	48	48
	Req'd Buses for Base Service				**4**														
	Additional for Peak Service (17:00)				**1**														
A20	DONOSTIA-SAN PEDRO	30		60			24	24	24	24	24	24	24	27	25	26	25	25	24
A20	SAN PEDRO-DONOSTIA	30		60			33	**36**	33	29	29	29	29	**32**	28	**45**	28	28	29

Table 2: Calculated cycle times, Donostialdea-Este, February 2010

A3	BERAUN-DONOSTI	35	30	15		*32*	41	41	37	35	35	35	35	36	36	36	37	33	*33*
A3	DONOSTI-BERAUN	40	30	15			37	33	38	36	36	36	36	**36**	37	37	37	37	*36*
	Total Cycle Time					*32*	**78**	74	75	71	71	71	71	72	73	73	74	70	*69*
	Req'd Buses for Base Service				**5**														
	Additional for Peak Service (7:00)				1														

Required Buses without Interlining: **40**

Table 3: Calculated cycle times, Donostialdea-Este, February 2010

	Route / Direction	Headway			7:00	8:00	9:00	10:00	11:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	Late Eve
a5	Hondarribia - Txinguidi	60			28	32	32	35	35	35	35	36	37	30	30	31	31
a5	TXINGUDI-HONDARRIBIA	60			NA	NA	31	31	31	31	31	34	35	35	45	33	33
	Total Cycle Time		0	0	NA	NA	63	66	66	66	66	70	72	65	**75**	64	64
i2	DONOSTIA-HONDARRIBIA (express)	45			51	**47**	**47**	60	60	65	45	**50**	60	48	52	38	38
i2	HONDARRIBIA-DONOSTIA (express)	45			34	**45**	**62**	39	39	39	39	38	**54**	**42**	35	34	
	Total Cycle Time				85	92	109	99	99	104	84	88	114	90	87	72	38
	a5 + i2 Round Trip						**172**	**165**	**165**	**170**	**150**	**158**	**186**	**155**	**162**	**136**	**102**
	a5+i2 Required Buses						4	4	4	4	3	4	4	3	4	3	2
H1	PASAI DONIBANE-DONOSTIA	20		*35*	**37**	34	33	33	33	33	36	37	36	36	36	*33*	
H1	DONOSTIA-PASAI DONIBANE	20		*34*	32	31	47	47	47	47	42	47	52	47	46	*45*	*27*
	Total Cycle Time			*69*	69	65	80	80	80	80	78	**84**	**88**	**83**	**82**	*78*	*27*
H2	OIARTZUN-DONOSTIA	20	39	45	45	45	45	45	45	45	31	47	47	47	*47*	*44*	*32*
H2	DONOSTIA-OIARTZUN	20	31	41	41	41	52	52	52	52	45	50	52	60	*47*	*48*	*36*
	Total Cycle Time		*70*	86	86	86	97	97	97	97	76	97	99	**107**	*94*	*92*	*68*
	H1 + H2 round trip				155	155	162	177	177	177	156	175	183	195	177	174	146
	H1 + H2 Required Buses				8	8	9	9	9	9	8	9	10	10	9	9	8

Required Buses with no interlining	40
Savings with simple interlining and service modifications	3
Total buses required	37

Table 4: Calculated cycle times and possibilities for interlining

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