# Fare policy decision-making guide

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## Purpose

The objective of this project was to develop a guide for fare policy decision-making. This report proposes a process for regional councils and the Auckland Regional Transport Authority (ARTA) to consider when developing or reviewing their fare policies or fare structures.

This guide does not represent NZTA policy, and it is not intended as a formal guideline that must be taken into consideration by regional councils. It is intended as a simple resource that can be applied and adapted for the purpose of aiding decision-making around fare policies, systems and structures.

## Background

The current focus of government is to improve investment returns by optimising the capacity and productivity of existing transport networks and services. The government aims to ease severe traffic congestion, improve overall reliability of urban transport networks and maximise the benefits from new and existing public transport expenditure. It is therefore essential that fare policies, structures, services, and levels encourage increased usage of public transport and balance patronage maximisation (subject to economic viability) and revenue maximisation. To facilitate this and to address overall funding constraints, some regions may need to re-evaluate services with low patronage and the periods where this is an issue.

The NZTA currently has no fixed policy position or formal guidelines for fare policy decision-making. This has implications for the level of subsidy required and how funding is split among users, ratepayers, and funding from National Land Transport Programme (NLTP) through fuel excise duty, road user charges, licenses and fees. This also has an impact on the ability to maintain and make improvements to services used to foster patronage. In addition, under the Public Transport Management Act 2008 it is now possible for ARTA and regional or territorial authorities to impose integration controls on a commercial service, for example, by allowing them to set and apportion integrated fares[1]. This could lead to deregistration of some commercial services affecting the overall level of subsidy required. Thus, a necessity for the NZTA Board is to ensure that the provision of the NLTP funding for public transport services and improvements represents value for money and supports an appropriate mix of funding (ie from users, ratepayers and NLTP).

Due to the lack of a nationwide structure for fare policy decision-making, regional councils and ARTA have developed varying fare policies, structures and decision-making processes. There are concerns that regional councils may, understandably, be making changes to their fares in response to a mixture of immediate crises such as cost, affordability, availability, and capacity; rather than taking a planned, long-term approach consistent with defined fare policy goals. Such an approach may require adjustments to future funding programmes to ensure adequate resources are allocated to public transport services. As it is a priority to increase the use of public transport networks and improve investment returns, the guidelines presented in this report aim to identify gaps and opportunities by providing an end-to-end process for regional councils to consider.

## Definition and calculation of farebox recovery

Discussion about farebox recovery is often limited to the discussion of fare price levels. Also regional councils and ARTA currently use different methodologies to calculate farebox recovery rates[2]. Therefore it is important that we define 'farebox recovery', discuss the determining factors and define a basic general calculation method.

Farebox recovery is the proportion of the amount of revenue generated through fares (tickets) by its paying customers as a fraction of the cost of its total operating expenses. Therefore, the calculation of farebox recovery is essentially a sum of the average ticket price multiplied by the number of passengers, then divided by the costs of service. The average ticket price needs to be calculated for various target groups, as each target group will have different ticket types and average ticket prices.

[1] The Public Transport Management Act 2008 is now under review, with a view to developing and increasing commercial services where possible.
[2] This will change with the introduction of the NZTA's national farebox recovery policy.

$$\text{Farebox recovery} = \frac{\sum\sum \text{(average ticket price * passenger number)}}{\text{costs of service}}$$

**Note**: this formula is for **explanatory** purposes only.

Direct cost information (with the possible exception of rail going forward) is difficult to obtain in New Zealand due to the contractual, private sector nature of public transport provision. Therefore, the actual formula in the NZTA's national farebox recovery policy uses operator income (from farebox revenue and public funding) as a proxy for operator costs, including profit margins.

For the NZTA's policy refer to the NZTA's national farebox recovery policy under 'Resources and Manuals' on the NZTA's website.

The calculation should take into account the whole network, so including free, contracted and commercial services. It is not accurate or reasonable to calculate farebox recovery rates only for contracted services. In areas with mixed systems (like in Auckland and Wellington), commercial services operate on routes and at times with high patronage and the contracted services often run on routes with lower patronage, so just measuring contracted services does not provide information on the whole picture. If there is no information about the costs of commercial services, these costs can be estimated by using the farebox recovery data with consideration of a percentage for overhead costs and profit. It may be useful or necessary, however, to calculate the farebox recovery of specific services or service times, considering different regions and service lines, for example to evaluate night services, route extensions or new routes. The farebox recovery rate should include all costs related to running the services, but exclude costs for infrastructure, management and marketing. Examples for infrastructure costs are bus stops, including passenger information equipment, train tracks and stations and rail vehicles. Other income types within the industry, eg from advertising at bus stops or on buses should be excluded when calculating the farebox recovery rate.

There are several measures that can be used to increase farebox recovery and it is not just a matter of fare price levels. Increasing farebox recovery can be achieved by:

- increasing average ticket prices (unless of course this has a negative impact on patronage)
- increasing patronage
- reducing the costs of service.

The following sections provide options in order to achieve increased farebox recovery.

## Measures to increase average ticket prices

In order to increase average ticket prices, decision-makers can consider revising the fare structure or raising the fare level. Another way is to avoid offering free services, as any passenger who receives a free service essentially means that their ticket price = $0 decreasing farebox recovery.

## Measures to increase patronage

Some measures that positively increase patronage are improving service quality, information quality and simplifying the integrated ticketing system.

Improving service quality can be achieved by improving the network, providing transfers, increasing frequency and service times, and reducing travel times. Other factors are reliability, comfort and tidiness of vehicles and stops as well as the customer service or friendliness of staff members.

*New initiatives to be considered*

It is evident that job tickets can also increase patronage. Job tickets are a result of a contract between the operator/public transport agency and employers. Employers essentially purchase tickets for all their employees, where employees who constantly use public transport can potentially receive more value. However, since not all employees are expected to use public transport, operators are able to benefit from the contractual arrangement.

Because employees will automatically receive the job ticket (whether the employer deducts it from their pay or not), they will be encouraged to use public transport. The reason for introducing job tickets is to promote public transport in a win-win situation and is not intended as a measure that will save taxes.

Currently, information to the public is mainly accessible through the internet, via information call centres, in the vehicles and at stops. By considering these key channels, it is important to look at the information available regarding the network and service, the real time departure/arrival times and about the fare system. The information provided should be consistent, kept up-to-date and understandable to the public. There will be less buy-in to public transport if the information provided is poor and fare systems overcomplicated.

### Measures to reduce costs of service

There are several measures that can be applied to reduce the overall costs of service. Costs of service is not necessarily a reflection of the quality of service. It is feasible to reduce costs without decreasing service quality. Decreasing service quality would negatively impact on the number of passengers who use the services.

One approach is to optimise schedules, frequencies and service times. This can be achieved by considering and then developing an integrated and structured network that is more adaptable to passenger demand. Another approach is to increase the availability of bus priority lanes or other priority measures, as this reduces travel times and the number of required buses, and can increase the number of passengers as it improves service quality and reliability.

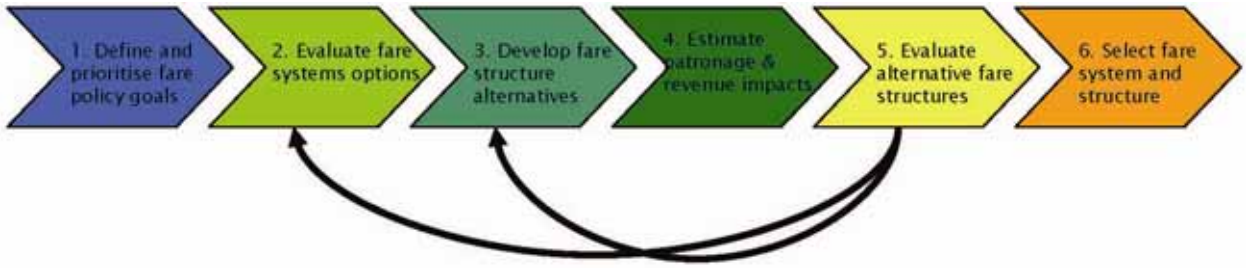
Offering job tickets and monthly passes are ways to reduce costs as this reduces travel times, since boarding and transaction times would be shorter because passengers would not need to buy a ticket at the time they board. As a result, the number of buses required would be reduced. Lastly, another way is by establishing competition for public transport operation through the use of service standards, for example regarding bus equipment, emissions and passenger information. More competition could be created by using options or possibilities given by the Public Transport Management Act 2008.

Due to the interrelated nature of the options or measures specified above, each option must be calculated very carefully and the effects identified. For example, when considering implementing bus priority lanes, this can positively impact the number of passengers and reduce the costs of service. On the other hand, when considering implementing a flat fare structure, while the number of passengers may increase, the average ticket price may also decrease and therefore such considerations need to be calculated carefully to ensure that the overall effect is positive.

## Decision-making process

Figure 1 depicts the six phase decision-making process. The first phase looks at defining and prioritising fare policy goals. The second phase looks at evaluating fare system options. This phase may be carried out concurrently with the third phase – develop fare structure alternatives, since the structure can only be enabled by the system that supports it. After the fare system and structure has been selected, the impact to patronage and revenue should be calculated (phase four). Phases 2-4 should be repeated until the most viable and beneficial option is apparent (phase five). Before selecting a fare system and structure, it is important that the effects or impacts on stakeholders are considered and calculated while adhering to the requirements of the government.

Figure 1: Six phase decision-making process



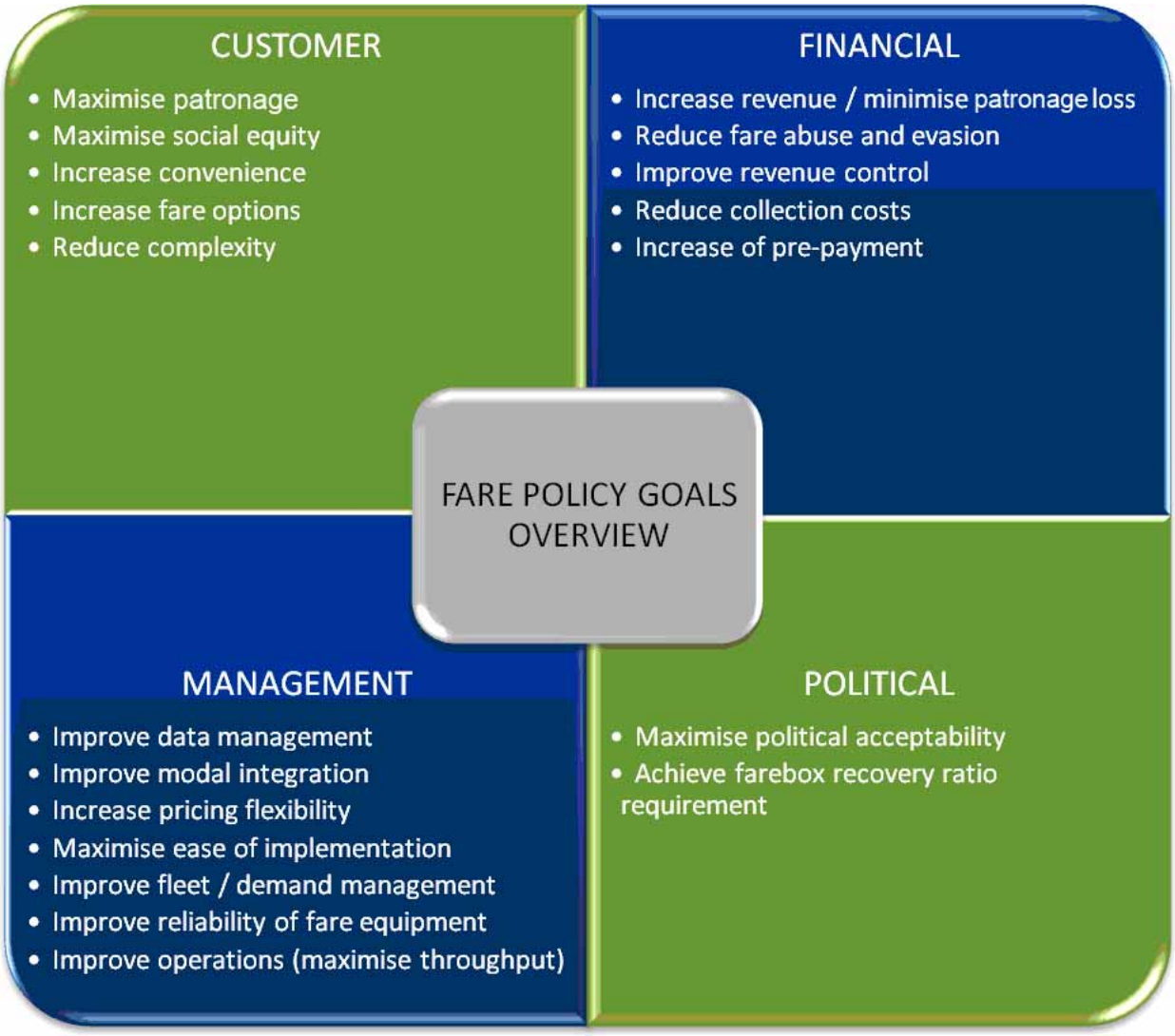
## Phase 1: Define and prioritise fare policy goals

The first phase is to define and prioritise the fare policy goals. In doing this, it is important to consider the various types of goals and the existing fare policy and systems. This allows the Regional Council and ARTA to analyse how current fare policy goals have worked with government requirements, systems and users. Other factors to consider when prioritising goals are patronage trends, revenue requirements, and legal requirements. By consulting the stakeholders and public, decision-makers will be able to make a more informed decision as insights and explanations about patronage trends are discovered. Some tools that enable this phase to be effectively carried out are an overview of fare policy goals and analysis of case studies.

*Fare policy goals framework*

Figure 2 categorises fare policy goals into four key areas: customer, financial, management and political. By separating goals into these categories, decision-makers are able to conceptualise and think about the various dimensions and prioritise goals accordingly. This model will also be applied in Phases 2 and 5 when evaluating fare systems and structures, and matching evaluation criteria against fare policy goals (as demonstrated later in this guide).

Figure 2: Fare policy goals framework



*Case studies*

Case studies are an excellent way of learning from others' experiences in a variety of situations or contexts to inform decision-makers when considering implementing a new fare structure or system. Based on experiences, policy goals differ significantly. For example, some areas focus predominantly on customers, while others prioritise maximising revenue.

When reading case studies it is important to highlight both the reasons for success and failure, but at the same time be aware that they contain different goals, priorities, processes, barriers, impacts and lessons learnt. As a result, case studies should be read from within its context or perspective and key lessons cannot be simply adapted to the New Zealand context without careful consideration of its effects within the New Zealand context.

Nevertheless, case studies have identified that the integration of multiple agencies to deliver regional fares is very complicated and that agencies generally participate in new types of partnerships. Studies have also shown that funding programmes are more often linked to specific market segments. Other key points from the research indicate that interoperable electronic ticketing is successful. However, the addition of applications is becoming more important. Employer and university pass programmes have also been very successful, but the pricing parameters for these types of passes have to be designed very carefully, with the calculation reviewed annually.

It is evident that the industry continues to favour simplified fare structures, as users are more likely to use public transport due to the ease of understanding and being able to quickly analyse their options. Most agencies reduce discounts and avoid deep discounts. Most agencies also continue to reduce fare zones and instead utilize flat fare structures without zones and peak / off peak differentiation. Lastly, research has also identified that free fare projects resulted in higher patronage, but increased the costs to provide the services.

## Phase 2: Evaluate fare systems options

The second phase is to evaluate fare system options. Within this phase potential systems (in terms of the technology) need to be identified and evaluated against a set of criteria. The weighting given to each criterion will need to be debated among the decision-makers. As a result, an analysis of system functionality, in particular its limitations, lifespan, and ability to enable policy objectives and priorities (identified in the first phase) must be defined for each system. The potential systems should be matched against the authority's own capability of delivering existing and planned fare structures. This phase often goes hand-in-hand with phase 3, but for the purposes of this report it has been separated to demonstrate that they are different processes and therefore require different considerations. Lastly, the financial costs, benefits and budget constraints must be considered as this impacts on the likelihood of obtaining a return on the investment.

Some examples of fare collection systems are barriers, conductor validation, pay on boarding and proof of payment. These systems are dependent on the feasibility or availability of purchasing tickets at different locations. Some technologies provide electronic or cash passes, which could be magnetic, contact or contact-less. Some common procedures for electronic systems are: check-in, check-in-check-out and be-in-be-out. Check-in pertains to systems that require the passenger to make contact with the terminal to ensure payment is made at the time of boarding. Check-in-check-out requires the passenger to interact with the terminal at the time of boarding and departing in order to calculate the fare price. Be-in-be-out is more innovative, as it is able to detect automatically whether the boarding passenger has a valid ticket without any interaction needed from the passenger.

Mobile phones have also shown to be an effective way to make payments, using Near Field Communications (NFC) and/or Java applications.

Figure 3 below applies the fare policy goals framework to evaluate potential systems. Each goal may or may not be relevant to the evaluation criteria for fare systems. For example, within the customer category, potential systems should be evaluated against its ease of use and understanding. When considering the financial aspects, the system's security and the cost of media and equipment should be taken into account. Within the management dimension, the impact on operations, detail of data, its accessibility, complexity, connectivity and ability to meet a flexible pricing arrangement should also be considered. The '-' symbol means that there is no evaluation criteria specified for the goal as the system's ability to maximise social equity for example provides no clear relationship that is measurable.

Figure 3: Fare system: application of fare policy goals framework

| Category | Goal | Evaluation criteria |
|---|---|---|
| Customer | Maximise patronage | - |
| | Maximise social equity | - |
| | Increase convenience | Ease of use |
| | Increase fare options | - |
| | Reduce complexity | Ease of understanding |
| Financial | Increase revenue/minimise patronage loss | - |
| | Reduce fare abuse and evasion | Security |
| | Improve revenue control | Accountability |
| | Reduce collection costs | Cost media, equipment |
| | Increase payment/reduce use of cash | - |
| Management | Improve data management | Detail of data, accessibility |
| | Improve modal integration | - |
| | Increase pricing flexibility | Flexibility regarding options |
| | Maximise ease of implementation | Complexity of roll out |
| | Improve fleet/demand management | Ability to connect into other public transport systems |
| | Improve reliability of fare equipment | Reliability of technology |
| | Improve operations (maximise throughput) | Impact on operation |
| Political | Maximise political acceptability | - |
| | Achieve recovery ratio requirement | - |

## Phase 3: Develop fare structure alternatives

The third phase involves developing an alternative fare structure. When working through this phase it is important to always bear in mind the objectives and priorities of the government and how the potential fare structures will contribute.

Fare structures are generally either classified as flat fare or distance-based, considering zones, sectors, trip kilometres or point-to-point fares. However, there are potential differentiations within a particular fare structure, as they can also be time-based (peak/offpeak), service-based or market based through passes which can also offer discounts. The existing fare structures and types should be assessed in order to understand the current situation and have justifications for reasons to change. Therefore, the advantages and disadvantages of fare structure and types will need to be identified (see figure 4 on next page).

Figure 4: Fare structure options

| Fare types | Advantages | Disadvantages |
|---|---|---|
| Flat fare | • Easy to understand<br>• Low cost to implement and administer<br>• Low level of fare abuse | • Places inequitable burden on customers making short trips<br>• A fare increase will cause greatest loss of users |
| Distance based | • Potential to generate most revenue<br>• Considered equitable, longer trips have the highest costs | • Difficult to use, to implement and to administer<br>• Could require specialised equipment<br>• May be vulnerable to fare abuse<br>• Could be unpopular with longer-trip customers |
| Time-based | • Should increase patronage<br>• Allows management of fleet usage through shift to off-peak<br>• Considered equitable, commuters pay more | • Potential for conflict between customers and drivers<br>• Potential for fraud<br>• Could require specialised equipment |
| Service based | • Relatively easy to understand<br>• Considered equitable, higher quality or higher priced services cost more<br>• High revenue potential | • Unpopular with customers using higher cost services<br>• Complicates transfers – may require payment of 'upgrade' fare in transferring |
| Market based | • Increase of patronage<br>• Generally considered equitable, offers the ability to pay less<br>• Can make fare increases politically acceptable<br>• Can minimise patronage loss with fare increase<br>• Maximises prepayment | • Produces lowest revenue per passenger<br>• Potentially higher level of abuse<br>• Requires extensive marketing to increase patronage<br>• Higher media production and distribution costs |

Lastly, when considering alternative fare structures, as specified in the previous phase, this is subject to functionality or limitations of the fare collection system since the fare structure can only be enabled by the system implemented. Potential legal, political and implementation constraints will also need to be discussed or debated along with the criteria and weightings for evaluation.

## Phase 4: Estimate patronage and revenue impacts

Once a potential fare structure has been developed, the next step (Phase 4) will involve estimating patronage impacts and the impacts on generating revenue. Patronage trends are affected by a variety of factors. The data used for estimating must be reliable along with the model and elasticities. Without ensuring reliability, results may be inaccurate and can cause an implementation of an infeasible fare system or structure and not obtain the required patronage or revenue to justify the change. Therefore, appropriate financial and human resources must be available for modelling.

At the time of writing, there are no up-to-date elasticity estimates available for New Zealand. Past evidence suggests that they do not differ significantly from those in Australia or the UK. Typical short-run values would be in the range of -0.2 to -0.6 for bus and -0.2 to -0.5 for rail with long-run values typically double the short run. This suggests that while raising fares will increase revenue, most of the effect on revenue will be dampened in the long run by the offsetting fall in passenger demand.

Other research findings include:

- **Trip purpose/time –** Elasticities for off-peak and non-work trips are typically twice those for peak/work trips; while weekend elasticities are higher still.
- **Trip distance –** Elasticities are highest for very short trips (up to 1-2km, where walking is a ready substitute); lowest at medium distances (typically 4-8km); then increase somewhat, but decrease for longest distance trips (often beyond the urban area).
- **City size –** Some international evidence suggests that elasticities are lower in larger cities (over 1 million), although this is not conclusive and likely to be compounded with other effects, such as trip length.
- **Base fare level –** Some evidence suggests that elasticities are proportional to the absolute level of fares and are not constant over different fare levels.

## Phase 5: Evaluate alternative fare structures

As with previous phases when evaluating alternative fare structures, it is always important to reassess whether potential options presented align with the government's goals and priorities. Phase 5 is a cyclical process, evaluating alternative fare structures and price levels until the best option is visible. There are essentially two levels:

- The evaluation of the fare structure (eg zonal fare vs. flat fare), and
- The evaluation of price levels, discounts and ticket types which fit in the structure.

Fare structures should be evaluated once every three to five years whereas price levels should be evaluated yearly, as costs or external factors such as employees' income fluctuate. Factors to consider are again the criteria and weightings applied for the evaluation, as well as the different pricing and discount arrangements. Tools that can aid this process are presented in figures 5, 6 and 7 below.

Figure 5 applies the fare policy goals framework introduced in Phase 1. Criteria needs to be specified in order to ensure goals are addressed and therefore impacts have been considered before coming to a decision.

Figure 5: Fare structure: application of fare policy goals framework

| Category | Goal | Evaluation criteria |
|---|---|---|
| Customer | Maximise patronage | Impact on patronage |
| | Maximise social equity | Impact on equity |
| | Increase convenience | Ease of use |
| | Increase fare options | Range of options |
| | Reduce complexity | Ease of understanding |
| Financial | Increase revenue/minimise patronage loss | Impact on fare revenue |
| | Reduce fare abuse and evasion | Impact on fare abuse |
| | Improve revenue control | - |
| | Reduce collection costs | Impact on collection costs |
| | Increase payment/reduce use of cash | Impact on payment |
| Management | Improve data management | - |
| | Improve modal integration | (depends on pricing options) |
| | Increase pricing flexibility | - |
| | Maximise ease of implementation | Ease of implementation |
| | Improve fleet/demand management | Impact on demand management |
| | Improve reliability of fare equipment | - |
| | Improve operations (maximise throughput) | - |
| Political | Maximise political acceptability | Political acceptability |
| | Achieve recovery ratio requirement | (depends on pricing of options) |

Figure 6 rates the various fare structure options (specified in figure 4) against its ability to meet each criterion (as specified in figure 5). The weightings for each criterion in contributing to the overall goal will need to be debated and filled in the appropriate field (as shown below), as the priorities for various regions differ. The ratings for each fare structure is indicative and can be changed to reflect the decision-makers' agreed opinion. The rating scale could also be 1 to 5, 1 to 10 etc... In this instance, a rating of 3 means that the structure provides a high impact to the criteria even if the criteria may have a low weighting to the overall score, whereas a rating of 1 indicates that structure provides a low impact. For example, a market-based structure can have a highly positive influence (or impact) on patronage, whereas distance-based or service-based structures have the lowest impact on this criteria/goal. Figure 6 can be used to rate the existing fare structure and to compare it with other options. If combined systems need to be evaluated, for example, a flat fare structure with a service- based differentiation, for each criterion the average rate should be considered (in this case the rate for impact on patronage would be 1.5).

This assessment should be done every 3-5 years to ensure that the structure is optimal for the public and achieves the government's goals and priorities.

Figure 6: Fare structure evaluation matrix

| Goal | Criteria | Weight | Rating | | | | |
|---|---|---|---|---|---|---|---|
| | | | Flat fare | Distance-based | Time-based | Service-based | Market-based |
| Customer | Impact on patronage | | 2 | 1 | 2 | 1 | 2 |
| | Impact on equity | | 1 | 3 | 2 | 2 | 1 |
| | Range of options | | 2 | 1 | 2 | 2 | 2 |
| | Ease of use | | 1 | 1 | 2 | 2 | 1 |
| | Ease of understanding | | 3 | 1 | 2 | 2 | 3 |
| Financial | Impact on fare revenue | | 2 | 3 | 1 | 3 | 2 |
| | Impact on fare abuse | | 1 | 3 | 2 | 3 | 1 |
| | Impact on collection costs | | 3 | 2 | 2 | 2 | 3 |
| | Impact on prepayment | | 1 | 1 | 2 | 2 | 1 |
| Management/ political | Ease of implementation | | 3 | 2 | 1 | 2 | 3 |
| | Impact on demand management | | 2 | 2 | 2 | 3 | 2 |
| | Political acceptability | | 1 | 3 | 3 | 2 | 1 |
| **TOTAL** | | 100% | Overall ranking | Overall ranking | Overall ranking | Overall ranking | Overall ranking |

Figure 7 categorises the goals/criteria into two dimensions: quantitative and qualitative. The quantitative dimension looks at maximising patronage and farebox recovery, whereas qualitative focuses on goals which cannot be easily quantified in monetary terms such as: public acceptability, equity, convenience and ease of use. As a result, qualitative goals are scored against the various options, rather than being calculated percentage wise as with the quantitative goals. The score could be '+1' if the impacts are positive, '0' if there is no major influence and '-1' if the impacts are negative. This assessment should be done yearly in order to improve the existing fare structure and to adjust to fluctuations in costs and income of the public. The quantitative criteria can be transformed to scores using '+1' for high increase of patronage/revenue and '-1' for a high decrease to be able to calculate an overall score. If a higher differentiation is necessary, the scores for all criteria could have a bigger range, eg from -3 to +3.

Figure 7: Price level evaluation matrix

| Goal | Criteria | Weight | Percentage of change/score | | | |
|---|---|---|---|---|---|---|
| | | | Existing situation | Option 1 | Option 2 | Option 3 |
| Qualitative | Maximise patronage | | % | % | % | % |
| | Maximise farebox recovery | | % | % | % | % |
| Quantitative | Public acceptability | | score | score | score | score |
| | Equity | | score | score | score | score |
| | Convenience | | score | score | score | score |
| | Ease of use | | score | score | score | score |
| TOTAL | | 100% | Overall score | Overall score | Overall score | Overall score |

### Phase 6: Select fare system and structure

Once a thorough evaluation has been carried out, a decision as to the most beneficial and feasible structure and system should be selected. Documentation should be kept together and signed off by the relevant parties in order to justify any decisions and so that the work can be revised at a later stage.

## Conclusion

Since calculation of farebox recovery focuses on average ticket prices, passenger levels and costs of service, each of these factors must be considered individually and carefully. When deciding to increase ticket prices (whether it be through changing the fare structure and price levels, or price levels alone) it is imperative that the impacts on the public and the government's goals/priorities are calculated using reliable data and information. It is realistic to expect that the fare structure will not be revised every year, but should be revised every 3-5 years. The price levels, discounts and ticket types within the existing fare structure however, should be revised yearly to ensure that the target farebox recovery is met.

It should be noted that farebox recovery is only one criterion to evaluate the effectiveness and efficiency of public transport systems. Other important criteria are capital costs for infrastructure, management costs and service costs/revenues per service kilometre, per passenger and per capita.