

## Impact of Transfer on Transit Attractiveness

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Walking from origins to transit stops, transferring between transit lines and walking from transit stops to destinations—all add to the burden of transit travel. Transfer, in particular, has been shown to produce an additional penalty that is independent of time that it takes to transfer. Riders usually have a negative perception of transfer because of the inconvenience which can be termed as “transfer penalty”. This transfer penalty is composed of several components: penalties due to walking while transferring, due to waiting for the connecting vehicle, extra cost and uncertainty. Some of these attributes of the transfer are often lacking in most of the existing literature. Understanding what impacts the transfer penalty and the contribution of each component can have significant implications for a transit authority, helping to identify which types of system improvement can most cost-effectively improve transfers, and thus attract more passengers. Such an understanding should also lead to potential improvements in ridership forecasting models.

This paper describes an investigation of the impact of transfer on transit mode choice by decomposing the transfer penalty into transfer walking distance and transfer waiting time. The approach is to consider alternative utility functions with different representations of the transfer component and sub-components, including piecewise-linear and separated forms for the sensitivity parameter.

The empirical data used were obtained in stated preference experiments of transit mode choice comparing LRT and bus. Alternatives were described by specifying the amounts of time spent on vehicle, access, transfer and egress walk distances, fare, and transfer wait time. Indications of socio-economic characteristics and level of experience of transit use were also collected. A total of approximately 452 interviews were collected in April of 2010. These were used to estimate the parameter values for a range of different utility functions in logit models representing choice behavior. The Jack-knife estimation procedure was used to correct for the repeated measurements.

The results indicate, among other things, that a transfer is equivalent to about 25 minutes of ride time, that walking at transfer is more onerous than waiting at transfer, that 'per minute' sensitivity to transfer wait time goes down as time goes up, that transfer becomes more onerous for aged people, for female and for new users. Some of these findings are novel while others are consistent with work done previously, and these findings have some implications for both theory and practice.

**Key words:** *Transit Utility, Transit Attractiveness, Mode Choice, Transfer, Waiting Time, Walking Distance, Transit Service*

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