5.0 Definitions, Costing Methods, and Estimates

This chapter describes information included in each of the individual cost chapters (5.1-5.16), and defines the modes that are considered.

Chapters 5.1 through 5.16 define, describe and estimate specific transport costs. Costs are discussed in 2007 US dollars except where noted otherwise. Summaries of other studies in each *Estimates* section mainly cite the original currency units used, and summary tables provide conversions for selected studies in most chapters. Units are mainly US units (mile, foot, and U.S. gallon). Cost estimates are provided for eleven modes under Urban Peak, Urban Off-Peak, and Rural travel conditions (*Urban* includes cities, towns and suburbs – any area that regularly experiences congestion). These estimates are either dollars per vehicle-mile or per passenger-mile, depending on which is more appropriate.

Cost Chapter Sections
Each cost chapter has at least the following sections:

Definition: Defines the cost for this analysis.

Discussion: The existence of each cost, its relationship to transport activities and specific modes are explored, and useful background information is provided.

Estimates: Existing estimates of this cost are summarized, and in some cases an original estimate is provided.

Variability: Factors that may affect this cost are described.

Equity and Efficiency Issues: This discusses various issues related to the distribution of these costs, and the degree to which they are reflected in prices (direct, perceived user costs).

Conclusions and estimates: The cost is summarized and an estimate per vehicle mile is made for the 11 modes under Urban Peak, Urban Off-Peak, and Rural conditions. The weighted average of these three conditions (based on mileage estimates in Table 3-1) is also listed.

Automobile Cost Range: Minimum and Maximum costs are defined for Average Automobile travel. This is based on the highest and lowest reasonable estimates.

Information Resources: Additional resources are listed at the end of each chapter, many of which are available on the internet.

Each chapter has an index to allow quick access to each section. Longer chapters have additional sections and sub-sections which are listed in each chapter index.

These monetized cost estimates are generic, representing US and Canadian averages. These estimates can be reasonably used in other countries with similar vehicle costs, such as Australia, but adjustments are needed in areas with much higher vehicle operating costs or different vehicle characteristics. They can also be modified as appropriate for a particular situation. For example, a particular area's parking costs may differ from these estimates due to variations in real estate values, rates of free parking, and ratio of parking

spaces per vehicle. Additional modes can be added using these costing methods and this analysis framework. You may choose to exclude some difficult-to-measure costs from the monetized estimates, although the existence of such costs and any concerns about them should be discussed. For example, you may decide to omit land use impacts and transportation diversity cost values in a particular situation, but land use and transportation diversity impacts should still be described qualitatively.

Measuring Costs

Table 5-1 shows the distribution of vehicle travel.

Table 5-1 **Vehicle Miles Traveled (VMT) Distribution**

	Percent of Total
Urban Peak	20%
Urban Off-Peak	40%
Rural	40%

Rideshare and transit costs can be evaluated either from a marginal or average cost perspective. *Marginal* analysis assumes that the vehicle will be making the same trip anyway, so each passenger only incurs additional costs in terms of increased vehicle weight, increased internal accident risk and additional stops. An *average* cost analysis assumes that the vehicle trip would not occur without the need created by the passengers, so each passenger bears an equal share of total cost.

For most applications, ridesharing costs are most appropriately based on *marginal* impacts, assuming that the vehicle driver will take the trip whether or not there are rideshare passengers. Vanpool passengers also bear a share of additional costs of a van rather than a smaller vehicle that the driver would choose without a van pool program. Transit rider costs should usually be based on *average* costs, since transit services would not operate if riders did not use the system. However, a strategy that increases transit service load factors (i.e., additional person-trips without a proportional increase in vehicle trips) can have lower than average marginal costs. For example, if bus operating costs average $5 per vehicle-mile and carry an average of 10 passengers, the average cost is 50¢ per rider-mile. If a mobility management program increases average ridership to 12 passengers, the additional two passengers can be expected to add minimal incremental operating costs, so a marginal cost value could be used. Similarly, a ridership increase could be dealt with by replacing 40-foot buses with 60-foot articulated buses for a small incremental cost per vehicle mile.

Ideally, bus system costs would be divided into *capacity costs* which would be assigned to peak period travel (since the system's total number of buses and bus size are largely determined by peak trip needs), and *operating costs* which would be divided among all passenger travel. However, the data to calculate this is not easily available so bus costs are calculated based on overall system average occupancy rates.

Modes Defined

1. *Average Automobile.* A medium sized car that averages 21 mpg overall (16 mpg city driving, 24 mph highway driving), driven 12,500 miles per year. Automobile occupancy averages 1.5 overall, and 1.1 for Urban-Peak travel.

2. *Compact (Fuel Efficient) Car*. A small four passenger car that averages 40 mpg overall (34 mpg city driving, 46 mpg highway driving).

3. *Electric Car.* A medium size battery powered electric car based on current technology, which consumes an average of 0.5 kWh per mile of travel.

4. *Van* or *Light Truck.* A 14 passenger van or light truck that averages 15 mpg overall (14 mpg city and 20 mph highway driving). Occupancy is same as an automobile.

5. *Rideshare Passenger.* The incremental cost of an additional carpool, vanpool or transit rider, assuming the vehicle would be traveling anyway. Fuel efficiency is estimated to decline by 0.25 mpg plus 2% extra trip distance per additional passenger (2% extra miles to assemble a 2 person car pool, 10% extra miles to assemble a 10 passenger van). This means a 0.01 x 15 mpg = 0.15 mpg average fuel consumption premium in addition to the 0.25 reduction in fuel efficiency, giving a total average fuel cost of 0.4 mpg per rideshare passenger.

6. *Diesel Bus.* A 40 foot bus (total capacity 53 seated and 32 standing passenger) with 25 average passengers during peak periods, 8 average passengers during Urban Off-Peak, and 5 average passengers during rural travel, an overall average occupancy of 10 passengers, averaging 4.0 mpg.

7. *Electric Bus/Trolley.* A 65 maximum passenger bus or trolley with a peak period occupancy of 30 passengers, 10 average passengers at other times, an overall average occupancy of 14 passengers, and averages 6.5 mpg energy consumption equivalent.

8. *Motorcycle.* A medium size motorcycle that averages 45 mpg under urban driving conditions, and 55 mph under rural driving conditions.

9. *Bicycle.* A moderate priced bicycle ridden an average of 10 mph.

10. *Walk.* A person walking an average of 3 mph.

11. *Telework.* This represents two 11 mile commute trips avoided when employees work from home. That may underestimate VMT savings since telecommuters tend to have longer than average commute trips, but this is offset by the tendency of some telecommuters to take additional vehicle trips and to move farther from their job site when they have the option of working from home.