**Changes to DaySim to Represent Discounted Transit and Parking Cash-out for Employees in Specific Zones**

These changes are originally designed for use the Seattle-Tacoma Airport zone in that specific model, but are implemented in the general DaySim code so that they could also be used for other regions and zones.

New Configuration Settings

New user configuration properties are available as listed below in *italics*. These are added to in the DaysimFramework.Core. Configuration.cs

*WorkerPricingFirstZoneNumber*

*WorkerPricingLastZoneNumber*

The pricing changes below only apply to work trips to a usual workplace destination in a zone number in this range. By default, these are 0, so no zones qualify.

*WorkerPricingTransitFareDiscountFactor*

This is a fractional fare discount for the relevant work trips applied to the fare from the transit skims, which overrides the usual transit fare determination in PathTypeModel. By default this is 0. A value of 0.75 would give a 75% discount, or 25% of the standard transit fare. Any value equal to or greater than 1.0 gives a 100% discount, or free transit. The added code for this change is in Daysim.PathTypeModels.PathTypeModel.cs, in the method GetTransitPath.

Compared to transit fare discount, parking cashout is more complex to represent realistically because it requires a choice made by the worker, and different workers may be more or less likely to choose than others. We assume that the two most important factors in that choice are the other commute mode options they have to driving and parking at work and their household income. The relevant configuration settings are:

*WorkerPricingParkingCashoutAvailable*

*WorkerPricingParkingCashoutFractionUnderOneMile*

*WorkerPricingParkingCashoutFractionOneToThreeMiles*

*WorkerPricingParkingCashoutFractionTransitAvailable*

*WorkerPricingParkingCashoutFractionTransitNotAvailable*

*WorkerPricingParkingCashoutFractionLowIncomeThreshold*

*WorkerPricingParkingCashoutFractionLowIncomeModifier*

*WorkerPricingParkingCashoutFractionHighIncomeThreshold*

*WorkerPricingParkingCashoutFractionHighIncomeModifier*

Whether any specific worker chooses parking cashout is a stochastic choice based on a fractional probability determined by the settings above. If ParkingCashoutAvailable is set as TRUE, then the other eight values are used to determine the fractional probability. There are four base groups, listed from highest likelihood to least likelihood of opting for parking cashout:

* ParkingCashoutFractionUnderOneMile: Those with a residence to usual workplace distance at less than 1 mile (convenient walking or biking distance) may be the most likely to opt for cashout.
* ParkingCashoutFractionOneToThreeMiles Those with a residence to usual workplace distance at 1 to 3 miles (convenient biking distance but a fairly long walk) may also be more likely than average to opt for cashout, but less likely than those living within a mile.
* ParkingCashoutFractionTransitAvailable The largest group are those living more than 3 miles from the workplace and having transit to the workplace available.
* ParkingCashoutFractionNoTransitAvailable Those least likely to opt for cashout are those living more than 3 miles from the workplace with no transit available to the workplace. Those people would need to get a ride to work to avoid paying the higher (visitor) parking price.

The user can also have household income modify the likelihood to opt for parking cashout, with the concept that the cashout payment will be valued more by those with lower incomes. For example, if ParkingCashoutFractionLowIncomeThreshold is set at 50000 and ParkingCashoutFractionLowIncomeModifier is set at 1.4 and the fractional probability from the settings above is 0.25 (25%), then those with household incomes under 50000 will have a fractional probability of 0.25 \* 1.4 = 0.35 (35%). Likewise, , if ParkingCashoutFractionHighIncomeThreshold is set at 150000 and ParkingCashoutFractionHighIncomeModifier is set at 0.6 and the fractional probability from the settings above is 0.5 (25%), then those with household incomes above 150000 will have a fractional probability of 0.25 \* 0.6 = 0.15 (15%).

*WorkerPricingDailyParkingCostBeforeCashOut*

*WorkerPricingHourlyParkingCostBeforeCashOut*

*WorkerPricingDailyParkingCostAfterCashOut*

*WorkerPricingHourlyParkingCostAfterCashOut*

These four settings give flexibility in setting worker parking price in the relevant zone(s) with or without parking cashout. Typically pricing is either a daily price or an hourly price, although if both are specified as greater than 0 then the daily price is used as a maximum daily price. For example, without a cashout, the parking cost could be a fixed value of $2 per day, so the DailyParkingCostBeforeCashOut would be set at 2.0 and the HourlyParkingCostBeforeCashOut would be left at 0.0 (or not set at all). If neither of these are set, then the default values of 0 are used so employee parking would be free. After cashout, an employee would have to pay visitor parking prices. For example, airport visitor parking might be $10 per hour with a maximum charge of $50 dollars per day, so HourlyParkingCostAfterCashOut would be set at 10.0 and the DailyParkingCostAfterCashOut would be set at 50.0. If DailyParkingCostAfterCashOut was left at 0 or not set in this example, then the price would just be $10 per hour at the airport, with no maximum. An implicit assumption is that once the worker receives the parking cashout payment, that money goes into their general disposable income and is not used explicitly to pay for their travel to work. The code changes for parking cashout are made in the (non-nested override of the) RunModel method in Daysim.ChoiceModels.Default.Models.WorkTourModeModel.cs

Below are results for a few test runs, done with a 1 in 10 sample and run with ShouldSynchronizeRandomSeed=true and shadow pricing set to False so that random variations and changes in the shadow prices do not add spurious differences to the results. The 100% transit fare discount only gives a slight increase in transit use, while the parking cashout (with these settings) gives a much larger decrease in SOV mode share and an increase in the shares for all other modes.

Test run settings…. Base Test 1 Test 2

WorkerPricingFirstZoneNumber n/a 1 1

WorkerPricingLastZoneNumber n/a 1 1

WorkerPricingTransitFareDiscountFactor n/a 100 0

WorkerPricingParkingCashoutAvailable n/a False True

WorkerPricingParkingCashoutFractionUnderOneMile n/a n/a 0.7

WorkerPricingParkingCashoutFractionOneToThreeMiles n/a n/a 0.4

WorkerPricingParkingCashoutFractionTransitAvailable n/a n/a 0.25

WorkerPricingParkingCashoutFractionTransitNotAvailable n/a n/a 0.05

WorkerPricingParkingCashoutFractionLowIncomeThreshold n/a n/a 50000

WorkerPricingParkingCashoutFractionLowIncomeModifier n/a n/a 1.4

WorkerPricingParkingCashoutFractionHighIncomeThreshold n/a n/a 150000

WorkerPricingParkingCashoutFractionHighIncomeModifier n/a n/a 0.6

WorkerPricingDailyParkingCostBeforeCashOut n/a n/a 2

WorkerPricingHourlyParkingCostBeforeCashOut n/a n/a 0

WorkerPricingDailyParkingCostAfterCashOut n/a n/a 50

WorkerPricingHourlyParkingCostAfterCashOut n/a n/a 10

Selected run results….

Work tours to Zone 1 4,290 4,388 4,295

Tour mode share for Walk 0.5% 0.5% 0.6%

Tour mode share for Bike 0.7% 0.7% 0.8%

Tour mode share for Car SOV 57.8% 56.8% 50.5%

Tour mode share for Car HOV 2 13.0% 13.0% 14.4%

Tour mode share for Car HOV 3+ 8.6% 10.5% 8.7%

Tour mode share for Walk to Transit 11.9% 13.1% 14.7%

Tour mode share for Drive to Transit 7.5% 5.5% 10.3%