

To: William A Davidson
From: Matthew Martimo
Date: 10/14/2011
Subject: **BestPathOnly Fare Consideration Delivery – Transit Model Update**

Cube Voyager's PT program supports a myriad of different fare systems to model nearly any type of real-world system as part of its full multi-routing analysis. However, due to the nature of many fare systems it is not possible to calculate the fare as a part of the route building process. Instead the route must be known and then the fare can be evaluated. This is not a problem during a full run of PT as all the reasonable route options are fully enumerated and then fares are calculated and considered during the process of route evaluation.

However, with the simplified BESTPATHONLY analysis, the full set of routes are not enumerated. Instead to minimize processing time, only the 'best path' is built and used in an all-or-nothing assignment. Historically, when doing this type of analysis the user may assign boarding penalties to try and model some consideration of fares but the options were not sufficient. Likewise, it wasn't possible to properly skim the fare costs from the resulting path as fares were not considered in the analysis.

In order to enhance the route enumeration in general and better identify and report on the optimal path during a BestPathOnly analysis, two new features have been added to the PT program.

The first is the optional BestPathOnly subkeyword, EVALFARE, this will turn on all of the fare evaluation features available to the full PT multi-routing analysis. This includes support for all of the fare systems supported by Voyager's PT and all of the FAREA and FAREP options available in the SKIMIJ phase. However, this option will still not impact the optimal route identified by the BestPathOnly route enumeration.

The second is the optional BestPathOnly subkeyword, ENUMFARE, this will this will turn on a simplified fare model during the BestPathOnly route enumeration. In this case, the optimal route identified will have taken into consideration this simplified fare model during the path building. The user may specify one of two fare systems, DISTANCE or FLAT. A new parameter EFARE tells the program that the descriptions of this ENUMFARE system are available in the FAREI file.

This update is provided in the Cube Voyager 6.x series of software. A prerelease version can be downloaded from: <http://www.citilabs.com/beta/voyager600pre.zip>

The documentation updates follow.

BESTPATHONLY EVALFARE	?	Optional. If set to True, we allow fare to be calculated in the best path evaluation and skimming process. Default is False.
BESTPATHONLY ENUMFARE	?	Optional. If set to True, we allow a subset of fare systems to be considered in the best path enumeration process. Default is False. If <u>ENUMFARE</u> =T and no fare skimming and route evaluation is required, <u>EFARE</u> must be set to True to allow the input descriptions of fare systems with <u>FILE FARE </u> ,
PARAMETERS EFARE	?K	Optional. Flag indicating whether to input descriptions of fare systems. If <u>ENUMFARE</u> =T and no fare skimming and route evaluation required, <u>EFARE</u> must be set to True to allow fares to be considered during the <u>BESTPATHONLY</u> route enumeration process. Default value is False. This keyword will be ignored if FARE=T, or fare skimming (FAREA/FAREP) and route evaluation required.

EXAMPLES

As shown in Appendix, new sub-keywords (e.g. EVALFARE and ENUMFARE) that can be implemented using the latest PT version have been tested using the data provided from the NERPM (Northeast Regional Planning Model). Two examples for testing new sub-keywords are referred as Test 1 and Test 2, respectively. The zonal pair from origin zone 194 to destination zone 2204 has been reviewed to see the change of transit route costs between without-sub-keyword (e.g. 'ORG') and with-sub-keyword (e.g. 'TEST #') cases. In addition, the Test 3 shows an example to perform transit route enumeration using EFARE when either transit skimming or loading is not conducted.

TEST 1 - Example of 'EVALFARE' keyword

The 'EVALFARE=T' can be defined along with the 'BestPathOnly' keyword to allow fare to be calculated in the best path evaluation and skimming process. Note that the 'BestPathOnly=T' setting originally doesn't include the fare in calculating the route cost during evaluating the transit route. Hence, the user can't define 'Parameters Fare=T' with 'BestPathOnly=T' in the PT program, but it would be fine now by being set with 'EVALFARE=T'. In the tested example below, the cost for route evaluation is increased from 107.703 to 117.521 because it contains fare. Note that the routes are still enumerated using the original approach without fare in the cost computation.

< Settings in Factor & Parameter >

```
*** INPUT FACTOR FILE ***
;Global Settings          ; fare to be calculated in the best
  BESTPATHONLY=T, EVALFARE=T ; path evaluation process

*** SCRIPT PROGRAM ***
PARAMETERS FARE=T

*** ORIGINAL FARE FILE ***
FARESYSTEM NUMBER=1 LONGNAME="Local Buses" NAME="LB" STRUCTURE=FLAT
SAME=CUMULATIVE,
IBOARDFARE=0.90,FAREFROMFS=0.00,0.00,0.00,0.00,0.00,0.90,0.00
```

< Comparison of transit route costs for z# 194 -> z# 2204 >

```
*** ROUTE COST for ORIGINAL ***

REval Route(s) from Origin 194 to Destination 2204

194 -> 32376
32376 -> 22080 -> 2204 lines L8 WB
Cost= 107.703 Probability=1.0000
Fare= 0.90
```

*** ROUTE COST for TEST 1 ***

REval Route(s) from Origin 194 to Destination 2204

194 -> 32376

32376 -> 22080 -> 2204 lines L8 WB

Cost= 117.521 Probability=1.0000

Fare= 0.90

< Comparison of total skimming values between Original and Test 1 >

SKIM TYPE	ORIGINAL	TEST 1	DIFF	DIFF (%)
BUS IVTT	34,495,022	34,513,389	18,367	0.05
CIRCULAR IVTT	137,624	138,557	933	0.68
TOTAL FARE	805,784	804,810	-974	-0.12
BUS FARE	802,971	801,997	-974	-0.12
CIRCULAR FARE	2,813	2,813	0	0

TEST 2 - Example of 'ENUMFARE' keyword

The 'ENUMFARE=T' can be defined along with the 'BestPathOnly' keyword to allow fare to be calculated in the best path enumeration process. However, the 'ENUMFARE=T' also requires 'EVALFARE=T' to include the fare to the route cost during enumerating/evaluating the transit routes. Note that 'ENUMFARE=T' cannot be utilized without 'EVALFARE=T' once 'Parameters FARE=T' is defined. In the tested example below, the cost for route evaluation is increased from 107.703 to 162.248 because it contains the revised fare increased from \$0.9 to \$5 in the boarding fare. Hence, it is confirmed that the fare is added into the route cost.

< Settings in Factor & Parameter >

*** INPUT FACTOR FILE ***

;Global Settings ; to be calculated in the best
BESTPATHONLY=T, EVALFARE=T, ENUMFARE=T ; path enumeration & evaluation

*** SCRIPT PROGRAM ***

PARAMETERS FARE=T

*** REVISED FARE FILE ***

FARESYSTEM NUMBER=1 LONGNAME="Local Buses" NAME="LB" STRUCTURE=FLAT
SAME=CUMULATIVE,
IBOARDFARE=5.00,FAREFROMFS=0.00,0.00,0.00,0.00,0.00,0.90,0.00

< Comparison of transit route costs for z# 194 -> z# 2204 >

*** ROUTE COST for TEST 2 ***

194 -> 32376
 32376 -> 22080 -> 2204 lines L8 WB
 Cost= 162.248 Probability=1.0000
 Fare= 5.00

< Comparison of total skimming values between Original and Test 2 >

SKIM TYPE	ORIGINAL	TEST 2	DIFF	DIFF (%)
BUS IVTT	34,495,022	29,265,216	-5,229,807	-15.16
CIRCULAR IVTT	137,624	454,628	317,004	230.34
TOTAL FARE	805,784	3,288,483	2,482,700	308.11
BUS FARE	802,971	3,270,595	2,467,623	307.31
CIRCULAR FARE	2,813	17,889	15,076	536.05

TEST 3 - Example of 'EFARE' parameter

The 'ENUMFARE=T' can be defined along with the 'BestPathOnly' keyword to allow fare to be calculated in the best path enumeration process. In this case, the 'Parameters EFARE=T' indicates that the fare data would be input through the FAREI file. Since only the route enumeration is processed by this keyword, the route report doesn't show the detail information for the selected zonal pair as provided during evaluating the route. Note that either transit skimming or transit loading process should be implemented separately in the following step because the 'Parameters EFARE=T' setting doesn't work with the route evaluation. In the tested example below, the total skimming fares are changed because the transit routes are different by including the fare for the route enumeration.

< Settings in Factor & Parameter >

*** INPUT FACTOR FILE ***

```
;Global Settings          ; fare to be calculated in the best
BESTPATHONLY=T, ENUMFARE=T ; path evaluation process
```

*** SCRIPT PROGRAM ***

PARAMETERS **EFARE=T**

*** ORIGINAL FARE FILE ***

```
FARESYSTEM NUMBER=1 LONGNAME="Local Buses" NAME="LB" STRUCTURE=FLAT
SAME=CUMULATIVE,
IBOARDFARE=0.90,FAREFROMFS=0.00,0.00,0.00,0.00,0.00,0.90,0.00
```

< Comparison of transit route costs for z# 194 -> z# 2204 >

*** ROUTE COST for TEST 3 ***

REval Route(s) from Origin 194 to Destination 2204

194 -> 32376

32376 -> 22080 -> 2204 lines L8 WB

< Comparison of total skimming values between Original and Test 3 >

SKIM TYPE	ORIGINAL	TEST 3	DIFF	DIFF (%)
BUS IVTT	34,495,022	33,973,221	-521,801	-1.51
CIRCULAR IVTT	137,624	185,315	47,691	34.65
TOTAL FARE	805,784	794,115	-11,669	-1.45
BUS FARE	802,971	788,486	-14,486	-1.80
CIRCULAR FARE	2,813	5,629	2,817	100.16

APPENDIX

North Florida TPO
Transportation Planning Organization

Demonstration for 'BestPathOnly' Fare Process
(Comparison of transit route costs from Origin 194 to Destination 2204)

Original BestPathOnly Option

SKIM process for walk-access

- Script File
- Network File
- Line File 1
- System File 1
- NTLegs File 1
- Fares File
- Factor File 1

PUBLIC TRANSPORT 1

- Print File
- Network File
- Report File
- Route File 1
- Matrix File 1

Extracting PT path trace data

- Script File
- Record File

MATRIX 2

- Print File
- Print Data 1

TEST 1 - 'EVALFARE'

SKIM process for walk-access

- Script File
- Network File
- Line File 1
- System File 1
- NTLegs File 1
- Fares File
- Factor File 1

PUBLIC TRANSPORT 3

- Print File
- Network File
- Report File
- Route File 1
- Matrix File 1

Extracting PT path trace data

- Script File
- Record File

MATRIX 4

- Print File
- Print Data 1

Summary of SKIM values

- Script File
- Matrix File 1
- Matrix File 2

MATRIX 5

- Print File
- Print Data 1

TEST 2 - 'ENUMFARE'

SKIM process for walk-access

- Script File
- Network File
- Line File 1
- System File 1
- NTLegs File 1
- Fares File
- Factor File 1

PUBLIC TRANSPORT 6

- Print File
- Network File
- Report File
- Route File 1
- Matrix File 1

Extracting PT path trace data

- Script File
- Record File

MATRIX 7

- Print File
- Print Data 1

Summary of SKIM values

- Script File
- Matrix File 1
- Matrix File 2

MATRIX 8

- Print File
- Print Data 1

TEST 3 - 'EFARE'

Route enumeration

- Script File
- Network File
- Line File 1
- System File 1
- NTLegs File 1
- Fares File
- Factor File 1

PUBLIC TRANSPORT 9

- Print File
- Network File
- Report File
- Route File 1

Extracting PT path trace data from the enumerated routes

- Script File
- Record File

MATRIX 10

- Print File
- Print Data 1

SKIM process for walk-access

- Script File
- Network File
- Fares File
- Route File 1

PUBLIC TRANSPORT 11

- Print File
- Report File
- Matrix File 1

Summary of SKIM values

- Script File
- Matrix File 1
- Matrix File 2

MATRIX 12

- Print File
- SUMMARY_SKIM

*** TEST 1 ***

< INPUT FACTOR FILE >

;Global Settings ; fare to be calculated in the best

BESTPATHONLY=T, EVALFARE=T ; path evaluation process

< SCRIPT PROGRAM >

PARAMETERS FARE=T

< ORIGINAL FARE FILE >

FARESYSTEM NUMBER=1 LONGNAME="Local Buses" NAME="LB" STRUCTURE=FLAT SAME=CUMULATIVE,

IBOARDFARE=0.90,FAREFROMFS=0.00,0.00,0.00,0.00,0.00,0.00,0.90,0.00

*** TEST 2 ***

< INPUT FACTOR FILE >

;Global Settings ; to be calculated in the best

BESTPATHONLY=T, EVALFARE=T, ENUMFARE=T ; path enumeration & evaluation process

< SCRIPT PROGRAM >

PARAMETERS FARE=T

< REVISED FARE FILE >

FARESYSTEM NUMBER=1 LONGNAME="Local Buses" NAME="LB" STRUCTURE=FLAT SAME=CUMULATIVE,

IBOARDFARE=5.00,FAREFROMFS=0.00,0.00,0.00,0.00,0.00,0.00,0.90,0.00

*** TEST 3 ***

< INPUT FACTOR FILE >

;Global Settings ; to be calculated in the best

Key	Value
Scen. Name	Base
ZONES1	2494
NODEMIN	5000
REPI	194
REPJ	2204