Status report on development of the Ver. 2.3 travel model

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Ron Milone and Mark Moran
Metropolitan Washington Council of Governments (COG)
National Capital Region Transportation Planning Board (TPB)

Status of key activities

- Round 7.2 Coop. Forecasts (2,191 TAZ system)
  - Released mid-April
  - Round 7.2a will be released in a few months
- 2007/2008 Household Travel Survey
  - Not yet released, but on the way
- Updated (~3,700) TAZ system development
  - Remains in development, nearing completion
- Approaches for reducing V2.3 execution times
  - Progress made; status report addressed below

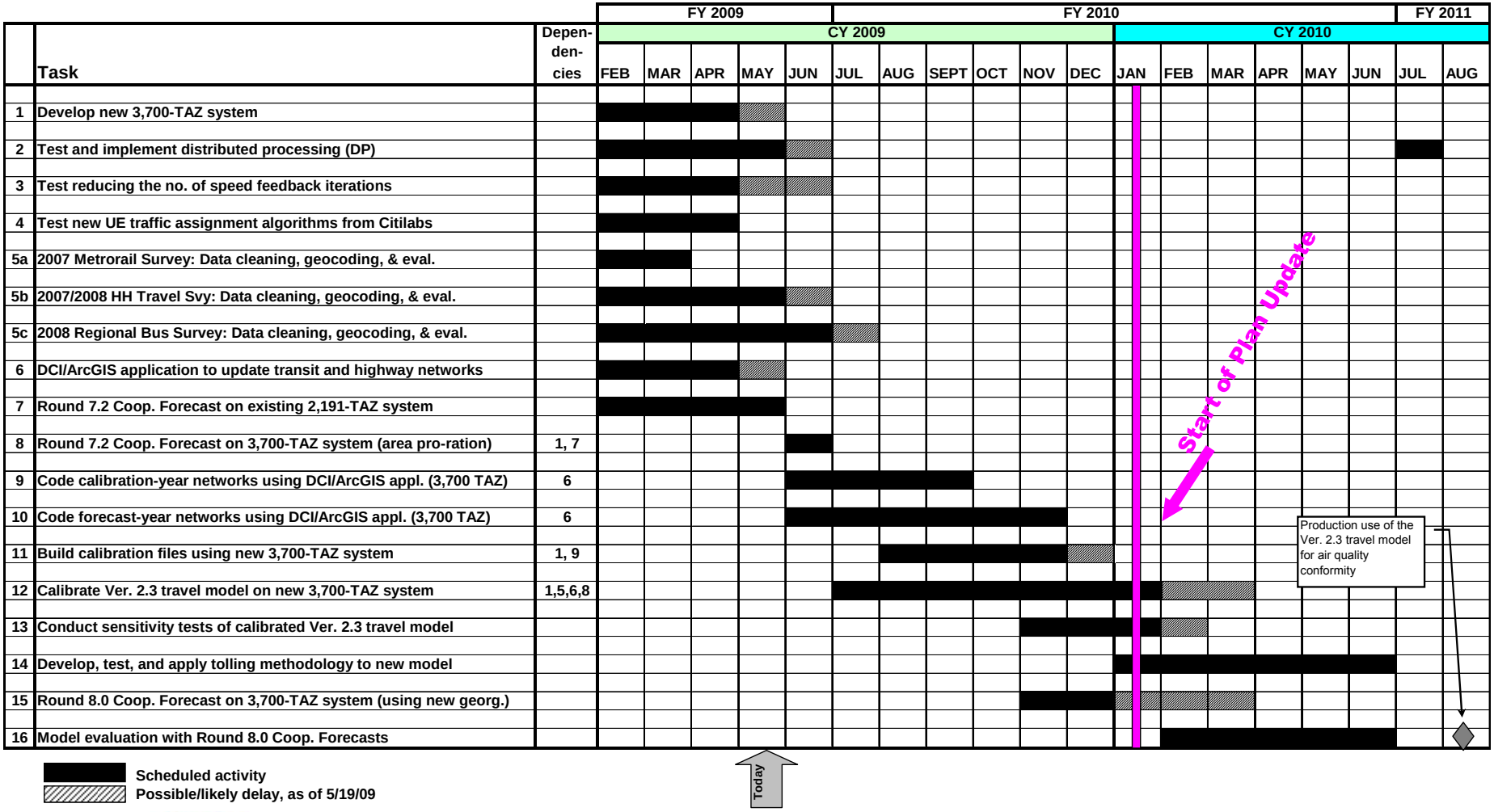
Status of network-related activities

- Ground counts
  - 2007 traffic counts being released today; status report later this morning
- Network conflation to NAVTEQ streets

  - Progress made; status report later this morning
- Network node numbering per new TAZ system
  - Thoughts on numbering addressed below
- GIS-transportation network project
  - Several versions have been tested; still in development

Development of Ver. 2.3 model on new zone syst.

Timeline for developing the Version 2.3 travel model on the new 3,700-zone system



TPB's scan of best modeling practices

- Current consultant: Cambridge Systematics, Inc.
- Previous tasks for CS
  - Fuel prices in travel models
  - Recommended near-term model enhancements
  - Framework for before-and-after study of HOV effects due to HOT lanes
- New tasks for CS
  - Improving the regional model's sensitivity to land use policy vis-à-vis the new TAZ system
  - Recommendations for feedback convergence methods

Distributed processing: Background

- Two phases of the Version 2.3 travel model account for about 2/3 of the model run time
  - Highway assignment: 51% of model run time
  - Nested-logit mode choice: 13% of model run time
  - (This is for the final loop – iteration #6 – of the travel model's six speed feedback loops)
- DP is implemented in Voyager via Cube Cluster
- Cube Cluster has two types of DP:
  - Intra-step distributed processing (IDP)
  - Multi-step distributed processing (MDP)

Distributed processing: Status

- Previously: We have used IDP and four processors on a test case of highway assignment (AM only) to reduce the run time for highway assignment by 50% (27 min. => 14 min.)
  - Extrapolating results to iteration #6 for all three time periods
    - 83 min. => 42 min. (41-minute time savings)

- Since last meeting: We have used MDP to run a test case of two instances of the NL mode choice model (AEMS.EXE) at the same time, resulting in a 40% time reduction (8 min. => 5 min.)
  - Extrapolating results to iteration #6 for all four trip purposes
    - 21 min. => 6 min. (15-minute time savings)

- Both these tests were done to a subset of the model, not the full travel model. We can further extrapolate the time savings to the entire travel model run

Distributed processing: Likely time savings

- Predicted/extrapolated time savings for an 18.5-hour model run
  - Highway assignment
    - 4.9 hours
  - Mode choice
    - 1.5 hours (= 15 min. x 6 speed feedback loops)
- Result
  - 18.5 hours => 12.1 hours (35% reduction)
- Caveats
  - One of our next steps is to implement IDP and MDP on the full model, which will allow us to validate this predicted time savings
  - If we cannot get IDP to work across the AM-PM-OP loop in highway assignment, we would need to have redundant code

Distributed processing: MDP on MC

- Without DP, in the existing Ver. 2.3 travel model, mode choice is called with a batch file (Mode_Choice.bat)
- With DP, mode choice is called with a Voyager script (since DP code cannot work within a batch file)
- Given that we are changing one batch file to a Voyager script, there may be other places where we may do the same
  - E.g., Trip_Generation.bat, Highway_Assignment.bat
  - We are still considering the pluses and minuses of this

Distributed processing: MDP on MC: Before and after

- Before: Without DP (Mode_choice.bat) Executes two instances of AEMS in series

```
if exist hbw_NL_MC.* del hbw_NL_MC.*
..\software\AEMS   ..\controls\HBW_NL_MC.ctl
if errorlevel 1 goto error

if exist hbs_NL_MC.* del hbs_NL_MC.*
..\software\AEMS   ..\controls\HBS_NL_MC.ctl
if errorlevel 1 goto error
```

- After: With DP (Voyager script) Executes two instances of AEMS in parallel

```
distribute intrastep=T multistep=T

*"C:\Program Files\Citilabs\CubeVoyager\CLUSTER.exe"  testDP 1
     start exit

DistributeMULTISTEP ProcessID='testDP', ProcessNum=1
*if exist hbw_NL_MC.* del hbw_NL_MC.*
**..\software\AEMS   ..\controls\HBW_NL_MC.ctl >con
EndDistributeMULTISTEP

; This second step can simply run on the main processor; the first
     step was already sent to processor 1
*if exist hbs_NL_MC.* del hbs_NL_MC.*
**..\software\AEMS   ..\controls\HBS_NL_MC.ctl >con

; wait for sub-process #1 to finish before continuing
Wait4Files Files=testDP1.script.end CheckReturnCode=T
     printFiles=MERGE

; Close down processing nodes
*"C:\Program Files\Citilabs\CubeVoyager\CLUSTER.exe"  testDP 1
     close exit
```

Distributed processing: Next steps

- Expand the MDP/mode choice test case so that it includes all four trip purposes for mode choice
- Implement DP on the full travel model
  - IDP for highway assignment (AM, PM, OP)
  - MDP for mode choice
- Long term: Investigate Cube Application Manager as a possible way of applying DP and the TPB travel model

Network node renumbering: Background

- Zone and node numbering within regional models: considerations
  - Developed sequentially:
    - Zone centroids (1- NZones)
    - PNR “centroids” (> NZones and < min. node#)
    - Highway nodes (> PNR centroids)
    - Transit nodes (> PNR centroids)
  - Developed with respect to software limitations and programming conventions
  - Developed to facilitate the accounting of nodes by jurisdiction or by transit submode
  - Developed with a desire to keep array sizes manageable, yet have the capacity to grow

Why is renumbering necessary?

- The highest TAZ number in the updated zone system (≈3,700) will be greater than the minimum existing highway node number (≈3,000)
- External station numbers will need to be re-sequenced
- The existing legacy numbering system has become cumbersome to manage over the years
- NL MC model includes new transit mode distinctions
  - Light rail, BRT/Streetcar
- Other considerations:
  - Max. node in existing system 23,193
  - Older software (TRNBUILD) max node # 65,534
  - Newer software (TRNBUILD) max node # 999,999

Objectives of new renumbering scheme

- Allow for unused TAZs for future sub-area work, but keep trip matrix dimension manageable
- Keep node ranges large enough to facilitate node accounting and future development needs, but small enough to minimize running times, and to be manageable (5-digit nodes, not 6-digit)

Current Node Dimensions

Based on 2008 CLRP, 2009-2014 TIP 2030 network (2,191 TAZs)

- Highway Network

Jurisdiction	Land Area (Sq. mi)	Physical TAZ Count	Avg. Size (Sq mi)	Highway Node Count	Hwy Nodes per Sq.Mi.
TOTAL Internal TAZs	6830.52	1,972	3.46	8,740	1.28

- Transit Network

Transit_Node_Type	Low Node	High Node	Node_Cnt
Metrorail Station Centroid:	2331	2510	117
Metrorail Station Node:	7301	7418	117
Metrorail Station PNR Node:	7451	7917	57
Commuter Rail Station Centroid:	2361	2623	86
Commuter Rail Station Node:	7601	20929	123
Commuter Rail Station PNR Node:	7527	7934	75
Bus/LightRail Station Node:	7674	21402	232
Bus/LightRail Station PNR Node:	7457	8298	178

Node Sizing Considerations

- Network node requirements should be increased to account for
  - Additional centroid connectors
  - Additional highway network detail required to support the new TAZ system
  - Allow for the potential option of more detailed network coding in the future (e.g., intersection coding)
  - Allow for potential option of more detailed Metrorail station coding

Proposed Highway and Transit Node Numbering System→

Node Type		Allotted TAZ's/Nodes	Beginning Node	Ending Node
TAZs (allocated by juris.)	District of Columbia	????	1	????
	.	.	.	.
	.	.	.	.
	.	.	.	.
	Jefferson Co., WVa.	????	????	~3700
	External Stations:	47	~3701	~3747
	Unused TAZs	~1,253	~3748	5000
Dummy PNR Centroids / & Station PNR Nodes	Metrorail PNR Centroids:	1,000	5001	6000
	Commuter Rail PNR Centroids:	1,000	6001	7000
	Light Rail/BRT PNR Centroids:	1,000	7001	8000
Station Nodes	Metrorail Station Node:	1,000	8001	9000
	Commuter Rail Station Node:	1,000	9001	10000
	Bus/LightRail Station Node:	1,000	10001	11000
	Unused Transit Nodes	9,000	11001	20000
Highway Nodes (allocated by juris.)	District of Columbia	2,000	20001	22000
	Montgomery Co., Md.	4,000	22001	26000
	Prince George's Co., Md.	4,000	26001	30000
	Arlington Co., Va.	2,000	30001	32000
	City of Alexandria, Va.	2,000	32001	34000
	Fairfax Co.. Va.	4,000	34001	38000
	Loudoun Co., Va.	2,000	38001	40000
	Prince William Co., Va.	2,000	40001	42000
	Frederick Co., Md.	2,000	42001	44000
	Howard Co., Md.	1,500	44001	45500
	Anne Arundel Co., Md.	1,500	45501	47000
	Charles Co., Md.	1,000	47001	48000
	Carroll Co., Md.	1,000	48001	49000
	Calvert Co., Md	500	49001	49500
	St. Mary's Co., Md.	500	49501	50000
	King George Co., Va.	500	50001	50500
	City of Fredericksburg, Va.	500	50501	51000
	Stafford Co., Va.	1,000	51001	52000
	Spotsylvania Co., Va.	1,000	52001	53000
	Fauquier Co., Va.	1,000	53001	54000
	Clarke Co., Va.	500	54001	54500
	Jefferson Co., WVa.	500	54501	55000

Next steps in models development

- Immediate activities: Preparing year-end documentation
  - Models development activities
  - Network Development activities
- Subsequent summer activities
  - Finalizing the new TAZ system
  - Continuing network development over new TAZ system
  - Analysis and logic checking of the HIS file
  - Calibration work in the fall