Item #5

The Supply Side of the Version 2.3 Travel Model

Presentation
to the
TPB Travel Forecasting Subcommittee

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Review Items

- Overview of TPB Cube Voyager transportation networks
- Elements and attributes of the networks
- Node numbering system
- The database supporting the development and management regional networks

Overview of TPB Cube Voyager Transportation Networks

What are the networks?

- Inputs to the travel model
  - Highway network
  - Transit network
- The basis for model outputs:
  - Highway link volumes (loads) by time period
  - Transit passenger flows on routes and highway segments
  - Zonal-to-zone level-of-service and cost information

Network Development Cycle

- Designed to reflect the evolving TIP and CLRP
  - Typically, the TIP & Plan are updated yearly
- Developed on the AQ Conformity cycle

Fall/Winter:	Base year transit line data updated with latest schedules
Winter:	TIP & Plan projects/policies are coded
Spring:	Travel and air quality modeling used to evaluate the State Implementation Plan (SIP)
Summer/Fall:	Technical process and findings are evaluated and considered for adoption

COG/TPB Modeled Study Area

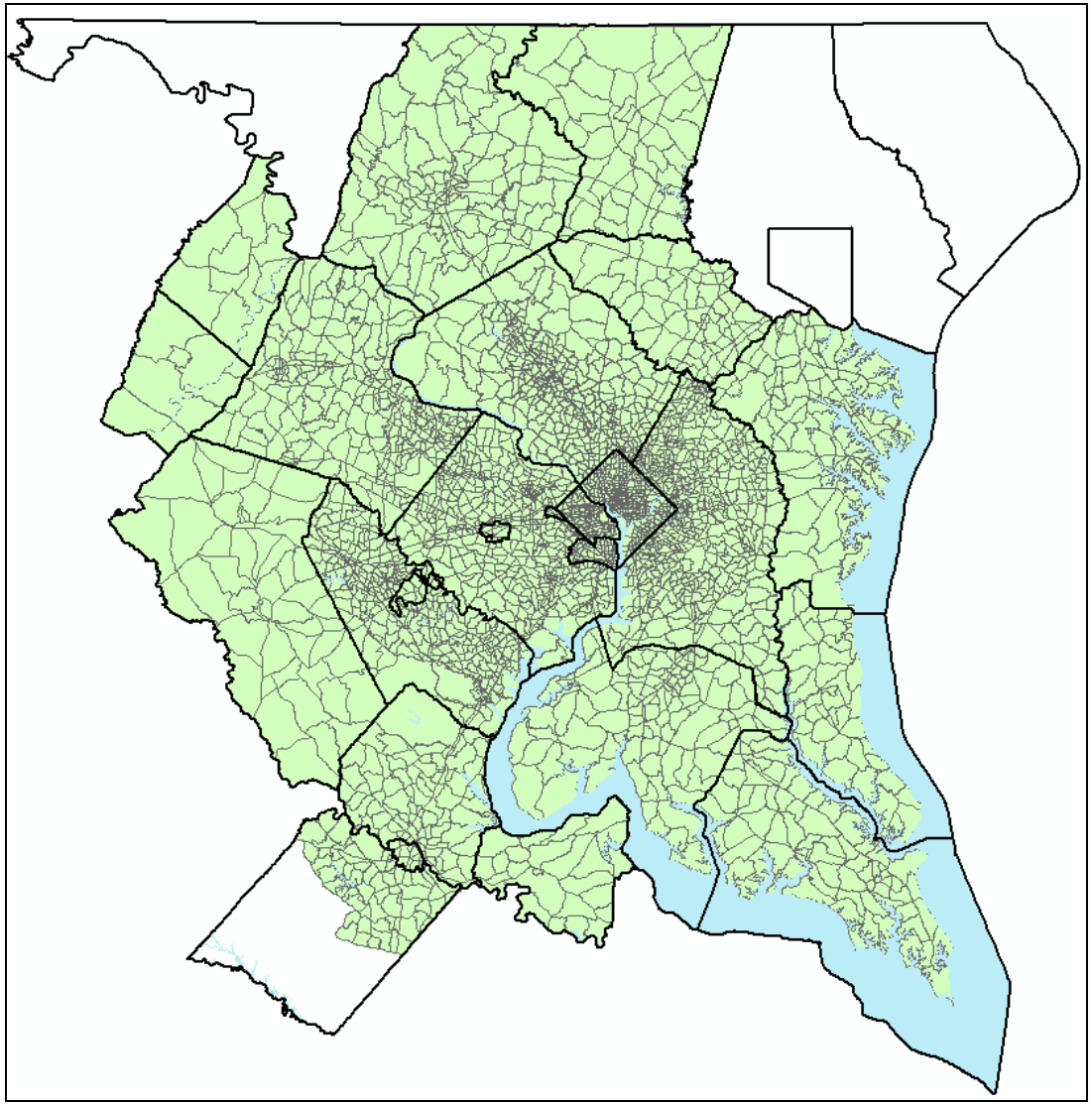
-3,722 TAZ's and external stations

- Land area: 6,800 square miles

-22 Major Jurisdictions

- Spans three states and the District of Columbia

- Southern section of Spotsylvania County is excluded from the study area



Modeled time periods

Highway Network Periods	
AM Peak	6 AM- 9 AM
PM Peak	3 PM- 7 PM
Off-Peak (Midday, nighttime & early morning)	12 AM- 6 AM 9 AM- 3 PM 7 PM- 12 AM

Transit Network Periods	
AM Peak	7 AM- 8 AM
Off-Peak	10 AM -3 PM

Elements and Attributes of the Networks

Elements of the highway network

"Point" locations

Travel Segments

Highway Network Element	Description
Zone Centroids	Activity location centers of internal TAZs
External Stations	Highway entry/exit points to the study area
PNR "Centroids"	PNR Lots locations. Used to develop restrained highway times between TAZs & PNR lots
Highway nodes	Highway intersections, junctions, or points of zonal/PNR access to highway system
Centroid connectors	Connection between TAZ centroid and highway network
PNR connectors	Connection between PNR lot and highway network
Highway links	Major highway segments

Elements of the transit network

(Folded on top of highway network elements)

	Transit Network Element	Description
"Point" locations	Bus stop nodes	Bus stops on the highway network
	PNR lots	Point location representing PNR lot
	Station	Point location representing heavy rail, LRT or BRT station
Travel Segments	Rail/BRT links	Fixed guideway segments connecting stations
	Walk access links	TAZ-to-transit stop bike/ pedestrian connections
	Auto access links	TAZ-to-PNR lot driving connections
	PNR lot-to station links	Walk transfer links from PNR lot to Station
	Station-to-bus transfer link	Walk transfer links between stations & bus stops
	Sidewalk links	Highway links/special links available for walk access
Transit Lines	Transit line files	Dsecription/alignment of Bus/ Rail routes
		(avg. frequency, runtime, node sequence of route)

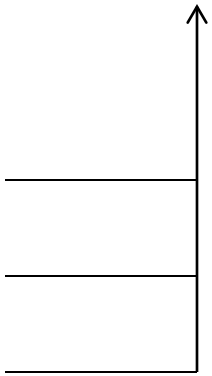
Cube Voyager network inputs

Input Type	Filename	Description	File Type
Highway Network	LINK.dbf	Highway Links file	DBF
	NODE.dbf	Highway Node coordinate File	DBF
	Toll_Esc.dbf	Toll parameter file	DBF
Transit Line Files		Transit Line Files	Text
	MODE1-9AM.TP		
	MODE1-9OP.TP		
Transit Infrastructure Files	met_link.tb, com_link.tb, lrt_link.tb, new_link.tb, met_node.tb, com_node.tb, lrt_node.tb, new_node.tb, bus_pnrn.tb, met_pnrn.tb, com_pnrn.tb, lrt_pnrn.tb, new_pnrn.tb, met_bus.tb, com_bus.tb, lrt_bus.tb,	Transit_Support files	Text
	Station.dbf	Rail Station/PNR File	DBF
	Lbus_TimFTRS.asc	Local bus future time degradation factor	Text
	Xtrawalk.dbf	supplemental walk link file	DBF

Highway Link Attributes

Variable Name	Description
A	A-Node
B	B_Node
DISTANCE	Link distance (in whole miles w/explicit decimal
JUR	Jurisdiction Code (0-23)
SCREEN	Screenline Code
FTYPE	Link Facility Type Code (0-6)
TOLL	Toll Value in current year dollars
TOLLGRP	Toll Group Code
AMLANE	AM Peak No. of Lanes
AMLIMIT	AM Peak Limit Code (0-9)
PMLANE	PM Peak No. of Lanes
PMLIMIT	PM Peak Limit Code (0-9)
OPLANE	Off-Peak No. of Lanes
OPLIMIT	Off-Peak Limit Code (0-9)
EDGEID	Geometry network link identifier
LINKID	Logical network link identifier
NETYEAR	Planning year of network link
SHAPE_LENGT	Geometry length of network link (in feet)
PROJECTID	Project identifier

Limit	Vehicles Allowed	Vehicles Disallowed
0	All Autos & Trucks	None
2	HOV 2+ Occ. Autos	1-Occ. Autos & Trucks
3	HOV 3+ Occ. Autos	1-& 2-Occ. Autos & Trucks
4	All Autos	Trucks
5	Airport Autos	All non-Airport Autos, Trucks
9	Transit Only	All Autos & Trucks



Attributes from the database

Existing Providers

Mode	Description	Transit Providers
1	Local Metrobus	WMATA - Local
2	Express Metrobus	WMATA- Express
3	Metrorail	WMATA- Metrorail
4	Commuter Rail	Commuter Rail
5	Light Rail	Light Rail, Streetcar
6	Other Primary Local Bus	Arlington County
		City of Alexandria
		Fairfax City
		Fairfax County
		Montgomery County
		Prince George's County
		Tyson's Circulator
7	Other Primary Express Bus	City of Alexandria - Express
		Fairfax County - Express

Mode	Description	Transit Providers
8	Other Secondary Local Bus	Bethesda Circulator
		Calvert County
		Charles County
		City of Laurel
		Falls Church
		Frederick County
		Fredericksburg Feeder Bus to VRE
		Greater Springfield Transit
		Howard County
		Loudoun County
		OMNI-LINK
		Rex Bus
		St. Mary's County
9	Other Secondary Express Bus	Lee Coaches Commuter Bus
		Loudoun County Commuter Bus
		Maryland MTA
		National Coach Commuter Bus
		OMNI-RIDE
		Quicks Commuter Bus
		Washington Flyer- Dulles/WFC

Transit line attributes

Variable Name	Description
Name	Name of Transit route
"Owner"	Text string containing origin & destination location
Oneway	Oneway indicator ("Y" or "N")
Mode	Mode designation of line
Freq	Headway of route in minutes (min: 2, max: 60)
Runtime	Scheduled running time of the route
N	Route of line over the network (node string)
Mode	Mode designation of line

Example:

```
LINE NAME="DCCE", OWNER="DCC;WISCONSIN & K STNW;UNIONSTATION;2009;BASE",
 ONEWAY= Y, MODE= 01, FREQ[1]= 10, RUNTIME= 30,
 N=  20576  21598  21597  20575  20573  20572  20571  20569  20567,
      20550  20551
```

Station file attributes

Variable Name	Description
SEQNO	Sequence no.
MM	Station Type (M, C, L, B, N)
NCT	Auto Access Type (0-3,8,9)
STAPARK	Parking lot indicator (Y,N)
STAUSE	Is Station in operation? (Y/N)
SNAME	Station Name
STAC	Station PNR centroid no.
STAZ	TAZ nearest station
STAT	Transit station node
STAP	Transit PNR node
STAN1	Bus transfer node
STAN2	Bus transfer node
STAN3	Bus transfer node
STAN4	Bus transfer node
STAPCAP	PNR capacity (spaces)
STAX	Transit station node X-coord.
STAY	Transit station node Y-coord.
STAPKCOST	Peak parking cost (cents)
STAOPCOST	Off peak parking cost (cents)
STAPKSHAD	Peak shadow cost (cents)
STAOPSHAD	Off peak shadow cost (cents)
FIRSTYR	Year of station, lot opening
STA_CEND	Station node -to-station centroid distance (ft.)

NCT Code	Description	Example Station
0	KNR Access allowed only, no PNR access	Clarendon
1	End-of-Line Station	Shady Grove
2	Suburban Station with parking	Twinbrook
3	Urban Station with parking	Fort Totten
8	Metro Station with long KNR links	Pentagon
9	Metro Station with no PNR/KNR access	Dupont Circle

Node Numbering

Overview of numbering

Zone and Node Numbering System				
		Node Range		TAZ / Node
Node Type	Node Subtype	Beginning	Ending	Count
	Internal (Apportioned by Juris.)	1	3,675	3,675
Zone Centroids	External Stations:	3,676	3,722	47
	Reserved TAZs	3,723	5,000	1,278
	Metrorail PNR Centroids:	5,001	5,999	1,000
Station Centroids	Commuter Rail PNR Centroids:	6,000	6,999	1,000
	Light Rail/BRT PNR Centroids:	7,000	7,999	1,000
	Metrorail Station Node:	8,000	8,999	1,000
Station Nodes	Commuter Rail Station Node:	9,000	9,999	1,000
	Bus/Light Rail Station Node:	10,000	10,999	1,000
	Metrorail PNR Lot Node:	11,000	11,999	1,000
PNR Lot Nodes	Commuter PNR Lot Node:	12,000	12,999	1,000
	Bus/Light PNR Lot Node:	13,000	13,999	1,000
	Reserved Transit Nodes	14,000	19,999	6,000
Highway Nodes	(Apportioned by Jurisdiction)	20,000	54,999	35,000

Zone (TAZ) numbering allocations

Jur. Code	Jurisdiction	TAZ Range Beginning	TAZ Range Ending	TAZ Count
0	District of Columbia	1	393	393
1	Montgomery Co., Md.	394	769	376
2	Prince George's Co., Md.	770	1,404	635
3	Arlington Co., Va.	1,405	1,545	141
4	City of Alexandria, Va.	1,546	1,610	65
5	Fairfax Co.. Va.	1,611	2,159	549
6	Loudoun Co., Va.	2,160	2,441	282
7	Prince William Co., Va.	2,442	2,819	378
9	Frederick Co., Md.	2,820	2,949	130
10	Howard Co., Md.	2,950	3,017	68
11	Anne Arundel Co., Md.	3,018	3,116	99
12	Charles Co., Md.	3,117	3,229	113
14	Carroll Co., Md.	3,230	3,287	58
15	Calvert Co., Md	3,288	3,334	47
16	St. Mary's Co., Md.	3,335	3,409	75
17	King George Co., Va.	3,410	3,434	25
18	City of Fredericksburg, Va.	3,435	3,448	14
19	Stafford Co., Va.	3,449	3,541	93
20	Spotsylvania Co., Va.	3,542	3,603	62
21	Fauquier Co., Va.	3,604	3,653	50
22	Clarke Co., Va.	3,654	3,662	9
23	Jefferson Co., WVa.	3,663	3,675	13
	Total Internal TAZs			3,675
	External Stations:	3,676	3,722	47
	Reserved TAZ numbers	3,723	5,000	1,278

Highway node numbering allocation

	Node Range		Node
Jurisdiction	Beginning	Ending	Count
District of Columbia	20,000	21,999	2,000
Montgomery Co., Md.	22,000	25,999	4,000
Prince George's Co., Md.	26,000	29,999	4,000
Arlington Co., Va.	30,000	31,999	2,000
City of Alexandria, Va.	32,000	33,999	2,000
Fairfax Co.. Va.	34,000	37,999	4,000
Loudoun Co., Va.	38,000	39,999	2,000
Prince William Co., Va.	40,000	41,999	2,000
Frederick Co., Md.	42,000	43,999	2,000
Howard Co., Md.	44,000	45,499	1,500
Anne Arundel Co., Md.	45,500	46,999	1,500
Charles Co., Md.	47,000	47,999	1,000
Carroll Co., Md.	48,000	48,999	1,000
Calvert Co., Md	49,000	49,499	500
St. Mary's Co., Md.	49,500	49,999	500
King George Co., Va.	50,000	50,499	500
City of Fredericksburg, Va.	50,500	50,999	500
Stafford Co., Va.	51,000	51,999	1,000
Spotsylvania Co., Va.	52,000	52,999	1,000
Fauquier Co., Va.	53,000	53,999	1,000
Clarke Co., Va.	54,000	54,499	500
Jefferson Co., WVa.	54,500	54,999	500
Total Nodes Allocated			35,000

Development & Management of the Regional Transportation Networks

Database background

- A comprehensive data repository
  - All highway and transit network elements are geographically referenced
    - ESRI ArcGIS Personal Geodatabase (PGDB)
    - Basemap: NAVTEQ
  - Multi-year storage of network elements
  - Highway and transit elements are dynamically linked
  - Custom ArcGIS-based editing interface used
  - Ability to export Cube Voyager files

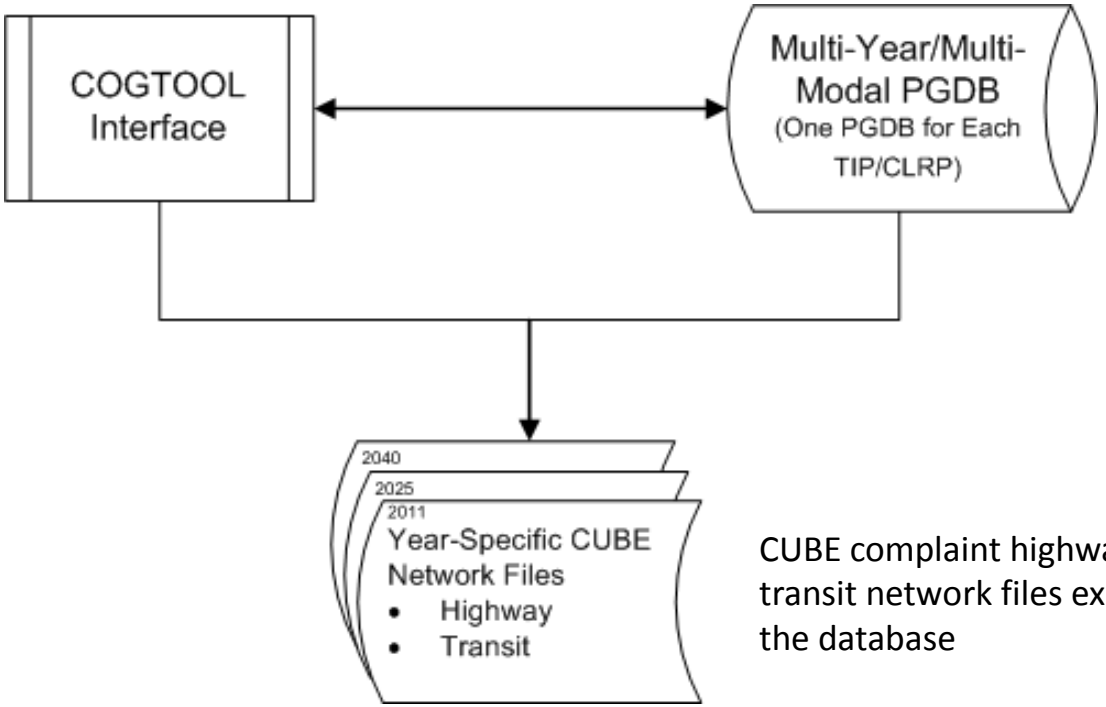
Benefits of PGDB approach

- Ensures greater consistency of networks used in a modeling project
- Enables True-Shape and satellite image display of network features
- Enables enforcement of network coding rules
- Linking highway edits to transit route (multi-year) files streamlines coding process
- Ability to link external geo-referenced files to the highway network
  - General Transit Feed Specification (GTFS)
  - INRIX highway speed data
  - NAVTEQ
  - Google Earth/Google Map

Network development overview

Single database containing comprehensive network data and network geography for multiple TIP/Plan years

Customized ArcGIS network editor

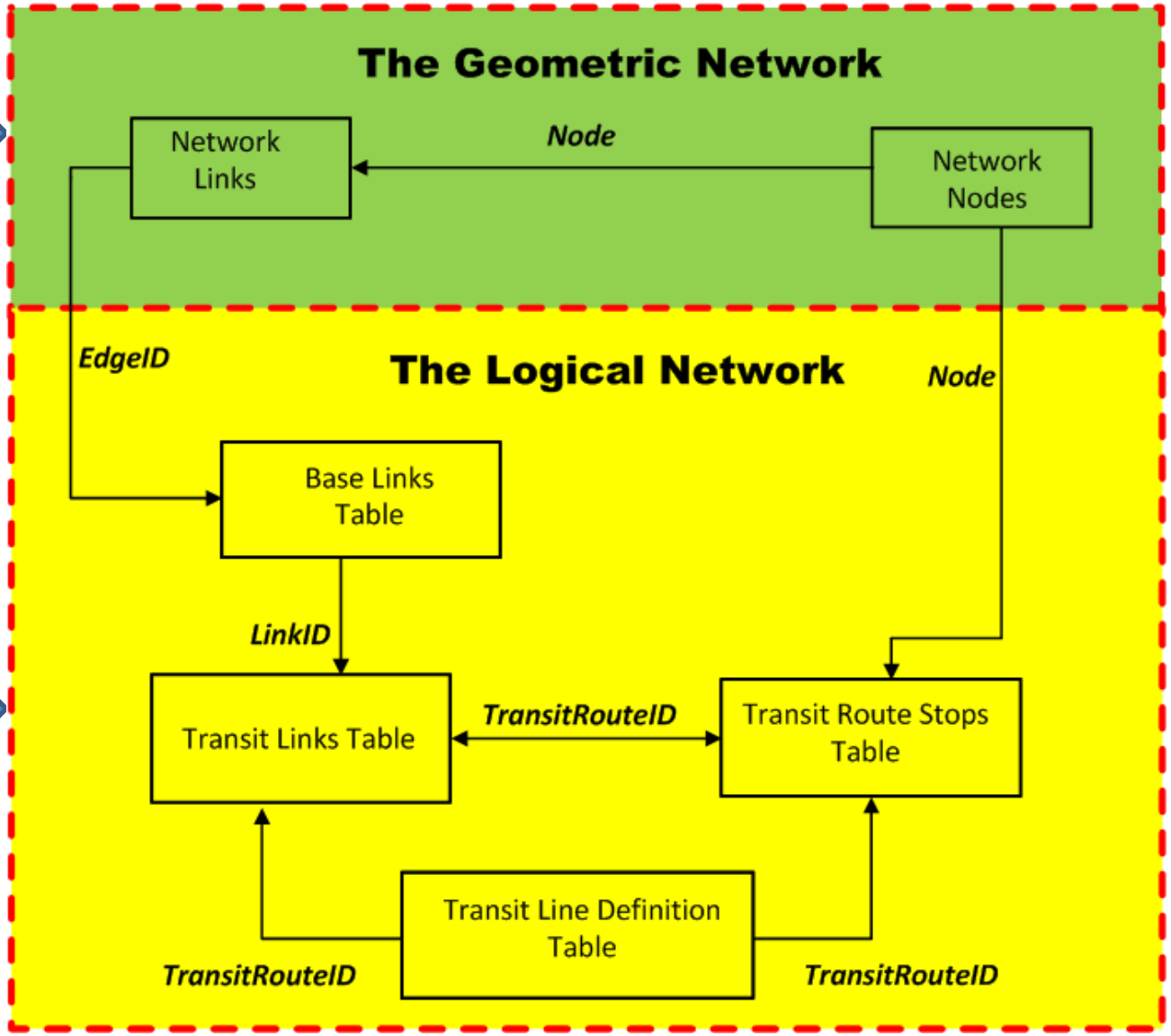


CUBE complaint highway and transit network files exported from the database

COG/TPB Geodatabase structure

"Mapping tables": Data relating to the geography of network features

"Data tables": Tables relating to model-related attributes of network features



Highway network table relationships

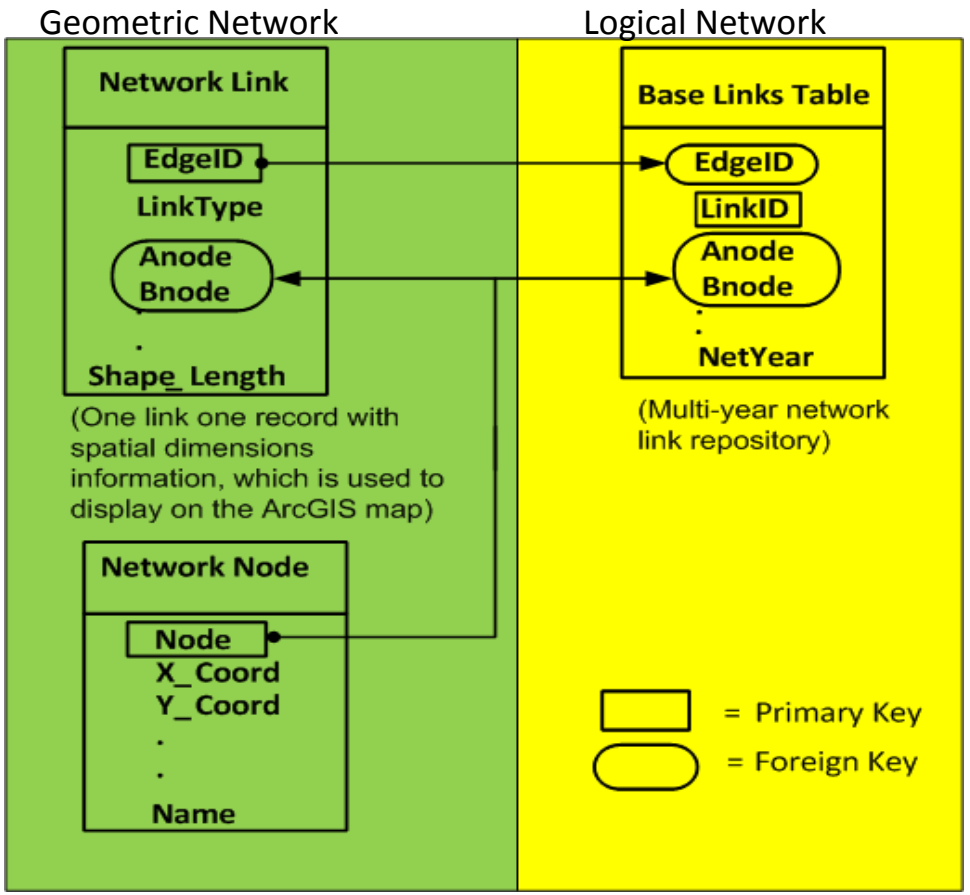
•EdgeID identifies the physical alignment of a network link and is a “primary key” variable

•EdgeID does not vary by direction or network year

Link ID	Edge ID	ANode	BNode	D	Net Year	F
26990	1	22165	22410		2000	
41956	1	22410	22165		2000	
39735	1	22165	22410		2020	M
60125	1	22410	22165		2020	M

•LinkID identifies the attributes of a network link and is a “primary key” variable in the Base Links Table

• LinkID varies by direction and/or network year



•A primary key is a field or set of fields that has a unique value for each record. The primary key is used to create table relationships.

•A foreign key, *simply stated, is another table's primary key. The values in a foreign key field match values in the primary key, indicating that the two records are related.*

Example : How a link is stored in the database

Networklink Table (Geometric)

Used for mapping/display
•not directional
•not year specific

EdgeID	LinkType	ANode	BNode	Oneway	Ramp Flag	Screen	JUR	Length	Shape_Length
1	1	22410	22165	1		0	1	0.12	651.8784968

Baselinks Table (Logical)

Stores detailed network link attributes
•directional
•Year-specific

Link ID	Edge ID	ANode	BNode	Distance	Link Type	Mode	TOLL	TollGrp	FType	LType	AType	AM Lane	PM Lane	OP Lane	AM Limit	PM Limit	OP Limit	Screen	Net Year	Project ID	ZoneID	Status	Jur	Count	Speed
26990	1	22165	22410	0.12	1		0	0	4	H	7	1	1	1	0	0	0	0	2000		556	1	1		
41956	1	22410	22165	0.12	1		0	0	4	H	7	1	1	1	0	0	0	0	2000		556	1	1		
39735	1	22165	22410	0.12	1		0	0	4	H		3	3	3	0	0	0	0	2020	MS6B	556	1	1		
60125	1	22410	22165	0.12	1		0	0	4	H		3	3	3	0	0	0	0	2020	MS6B	556	1	1		

Network Node Table (Geometric)

Provide X, Y Coordination of the Node

Node	NodeType	Jur	X_COORD	Y_COORD	Name
22165	1	1	1264819.65	539815.575	
22410	1	1	1264359.37	539357.508	

Network links table with "LinkType" codes (1-14) description

- A variable named “LinkType” is used to identify highway and transit network links

- The database is multi-modal

Simple feature class
NetworkLinks

Geometry *Polyline*
Contains M values *No*
Contains Z values *No*

Field name	Data type	Allow nulls	Default value	Description
OBJECTID	Object ID	No		Geodatabase record identifier
Shape	Geometry	No		Geodatabase geometry field
EdgeID	Long integer	No		Geometric network link identifier
LinkType	Long integer	No		Highway link, bus link, rail link, walk link, etc.
ANode	Long integer	No		Start geometry node identifier (TPB numbering system)
BNode	Long integer	No		End geometry node identifier (TPB numbering system)
FunctionClass	Long integer	Yes		Functional Classification of Highway
Oneway	Short integer	Yes		If it is one-way (for divided express-way)
RampFlag	String	Yes		If it is ramp
RouteID	Long integer	Yes		Route identifier (link to highway definition, e.g., I395)
RouteName	String	Yes		Full street name, e.g., 14th St. NW
UpdateBy	String	Yes		Name of person making update
Screen	Long integer	Yes		Screen line ID if the link intersects the screen line
JUR	Short integer	No		Jurisdiction code identifier
Length	Long integer	No		Link Length in feet
Shape_Length	Double	No		ArcGIS auto-generated geometry length in feet

Subtypes of NetworkLinks

Subtype field *LinkType*
Default subtype *1*

Subtype Code	Subtype Description
1	Highway Link
2	Bus Link
3	TAZ Connector
4	Metrorail Link
5	Commmuter Rail Link
6	Light Rail Link
7	Light Rail to Bus Stop
8	Metro Station to Bus Stop
9	Commuter Station to Bus Stop
10	Metro PNR to Station
11	Commuter PNR to Station
12	Bus PNR to Station
13	Light Rail PNR to Station
14	New Rail PNR to Station

Network Nodes table with "Node Type" codes (1-12) description

- A variable named "NodeType" is used to identify highway and transit network nodes

- The "NodeType" variable distinguishes PNR lots, transit stations, bus stops, as well as highway nodes

Simple feature class
NetworkNodes

Geometry *Point*
Contains M values *No*
Contains Z values *No*

Field name	Data type	Allow nulls	Default value	Description
OBJECTID	Object ID			Geodatabase record identifier
Shape	Geometry	Yes		Geodatabase geometry field
Node	Long integer	Yes		Node number (TPB numbering system)
NodeType	Long integer	Yes	1	Node type, e.g. intersection or connection
Jur	String	Yes		Jurisdiction code identifier
UpdatedBy	String	Yes		Name of person making update
X_COORD	Double	Yes		Node X coordinate
Y_COORD	Double	Yes		Node Y coordinate
Name	String	Yes		Transit Stop/Station Name
NetYear	Long integer	Yes		Planning Year of network (e.g., 2010)

Subtypes of NetworkNodes

Subtype field *NodeType*
Default subtype *1*

Subtype Code	Subtype Description
1	Highway Node
2	Bus Node
3	TAZ Centroid
4	Metrorail Node
5	Commuter Rail Node
6	Light Rail Node
7	Light Rail Parking Lot Node
8	Metro Parking Lot Node
9	Commuter Parking Lot Node
10	Bus/Light Rail PNR Node
11	Reserved Transit Parking Lot Node
12	Transit Station Centroid

Base Links Table with "Mode" codes (1-16) description

- A variable named “Mode” is used to identify the mode code associated with special transit links

- These “Mode” codes are consistent with transit conventions used in the Version 2.3 Travel Model

Table
BASELINKS

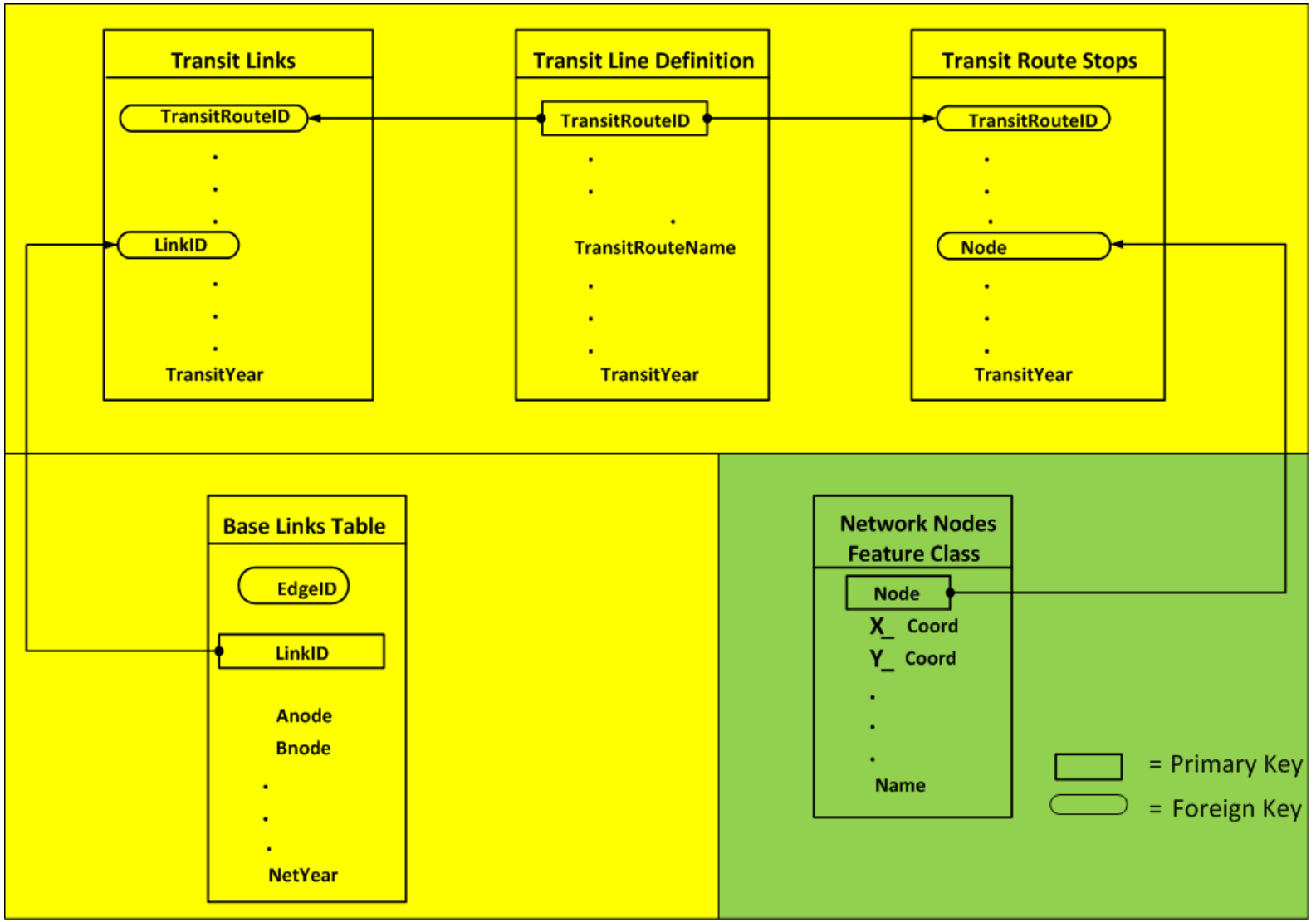
Field name	Data type	Allow nulls	Default value	Description
OBJECTID	Object ID	No		Geodatabase record identifier
LinkID	Long integer	No		Logical network link identifier
EdgeID	Long integer	No		Network link identifier – links to EdgeID in the Networklinks
ANode	Long integer	No		Start node identifier (TPB numbering system)
BNode	Long integer	No		End node identifier (TPB numbering system)
NDPR2	String	Yes		Combination of Anode and Bnode (2191 node system)
BaseYear	Long integer	Yes		Year of base (e.g., 2000)
TravelDirection	String	Yes		Geometry drawing direction
Distance	Double	Yes		Length of the link (in mile)
LinkType	Long integer	No		linked with the subtypes of the NetworkLink feature class
Mode	Long integer	No		Transit mode
TOLL	Short integer	Yes		If it is Toll lane
TollGrp	Long integer	Yes		Toll Group code
FType	Long integer	Yes		Link facility type code
LType	String	Yes		Link Type (reserved place holder)
AType	Long integer	Yes		Area type code
AMLane	Long integer	Yes		AM peak number of lanes
PMLane	Long integer	Yes		PM Peak number of lanes
OPLane	Long integer	Yes		Off peak number of lanes
AMLimit	Long integer	Yes		AM peak LIMIT code
PMLimit	Long integer	Yes		PM peak LIMIT code
OPLimit	Long integer	Yes		Off peak LIMIT code
Screen	Long integer	Yes		Screenline code
NetYear	Long integer	No		Planning Year of network (e.g., 2010)
ProjectID	String	Yes		Project identifier
ZoneID	Long integer	Yes		TAZ zone identifier
Status	Long integer	No		Link status (2=Retire 1=Active)
COGStatus	String	Yes		Reserved place holder
UpdateDate	Date	Yes		The date of link attributes updated
Jur	Long integer	Yes		Jurisdiction zone code
Count	Long integer	Yes		Traffic count on the link
Speed	Double	Yes		Travel speed

Coded value domain
Mode

Description *Transit Mode*
Field type *Long integer*
Split policy *Default value*
Merge policy *Default value*

Code	Description
1	Local Metrobus
2	Express Metrobus
3	Metro Rail
4	Commuter Rail
5	Light Rail
6	Other primary - Local bus
7	Other primary - Express bus
8	Other secondary - Local bus
9	Other secondary - Express bus
10	Bus Rapid Transit or Streetcar
11	Drive-Access to transit link
12	Bus-to-rail Transfer link
13	Side walk
14	TBD
15	Walk-access to transit link
16	Zonal Access or Egress

Relationship between transit and highway network tables



Example : How a transit route is stored in the database

Transit Line Definition Table

Transit Route ID	Transit Route Name	Origin Node	Destination Node	Origin Node Name	Destination Node Name	Mode	Headway	Run time	Operation	Scenario	Transit Year	SYear	Run Speed	Line Distance	Operator
1	WM07MI	32095	30206	MARK CENTER BUS BAY C	PENTAGON STATION & BUS BAY U6 HOV	1	15	10	2	BASE	2011	2011			WMATA

Transit Links Table

Transit Route ID	Link ID	ANode	BNode	Link Sequence	Scenario	Transit Year	SYear	Operation
1	52338	32095	32252	1	BASE	2011	2011	2
1	22156	32252	32136	2	BASE	2011	2011	2
1	59527	32136	32254	3	BASE	2011	2011	2
1	66148	32254	32257	4	BASE	2011	2011	2
1	66151	32257	32261	5	BASE	2011	2011	2
1	66358	32261	30396	6	BASE	2011	2011	2
1	28049	30396	30398	7	BASE	2011	2011	2
1	66364	30398	30402	8	BASE	2011	2011	2
1	65412	30402	30407	9	BASE	2011	2011	2
1	65413	30407	30410	10	BASE	2011	2011	2
1	28051	30410	30414	11	BASE	2011	2011	2
1	66372	30414	30419	12	BASE	2011	2011	2
1	66575	30419	30422	13	BASE	2011	2011	2
1	66576	30422	30425	14	BASE	2011	2011	2
1	37937	30425	30428	15	BASE	2011	2011	2
1	66580	30428	30433	16	BASE	2011	2011	2
1	28853	30433	30436	17	BASE	2011	2011	2
1	51011	30436	30439	18	BASE	2011	2011	2
1	57810	30439	30443	19	BASE	2011	2011	2
1	66583	30443	30355	20	BASE	2011	2011	2
1	68549	30355	30352	21	BASE	2011	2011	2
1	74054	30352	30351	22	BASE	2011	2011	2
1	36929	30351	30206	23	BASE	2011	2011	2

Transit Route Stops Table

Transit Route ID	Node	Node Sequence	Operation	Stop Flag	SYear	Scenario	Transit Year
1	32095	1	2	0	2011	BASE	2011
1	32252	2	2	0	2011	BASE	2011
1	32136	3	2	1	2011	BASE	2011
1	32254	4	2	1	2011	BASE	2011
1	32257	5	2	1	2011	BASE	2011
1	32261	6	2	1	2011	BASE	2011
1	30396	7	2	1	2011	BASE	2011
1	30398	8	2	1	2011	BASE	2011
1	30402	9	2	1	2011	BASE	2011
1	30407	10	2	1	2011	BASE	2011
1	30410	11	2	1	2011	BASE	2011
1	30414	12	2	1	2011	BASE	2011
1	30419	13	2	1	2011	BASE	2011
1	30422	14	2	1	2011	BASE	2011
1	30425	15	2	1	2011	BASE	2011
1	30428	16	2	1	2011	BASE	2011
1	30433	17	2	1	2011	BASE	2011
1	30436	18	2	1	2011	BASE	2011
1	30439	19	2	1	2011	BASE	2011
1	30443	20	2	1	2011	BASE	2011
1	30355	21	2	1	2011	BASE	2011
1	30352	22	2	1	2011	BASE	2011
1	30351	23	2	1	2011	BASE	2011
1	30206	24	2	0	2011	BASE	2011

Transit Lines Definition table

Table
TRANSITLINESDEFINITION

Field name	Data type	Allow nulls	Default value	Description
ObjectID	Object ID	No		Geodatabase record identifier
TransitRouteID	Long integer	No		Transit Route identifier
TransitRouteName	String	Yes		Transit Route name
OriginNode	Long integer	No		Start stop identifier of the transit route
DestinationNode	Long integer	No		End stop identifier of the transit route
OriginNodeName	String	Yes		Start stop name, e.g. UNION STATION
DestiNodeName	String	Yes		End stop name, e.g. BALLSTON STATION
Oneway	Long integer	No		One-way or two-way route
Mode	Long integer	No		Transit mode, e.g. bus, metro
Headway	Double	Yes		Ave. transit vehicle headway (minutes)
Runtime	Long integer	Yes		Ave. transit route running time (minutes)
Operation	Long integer	No		Operation time, e.g. AM peak or PM peak
SourceYear	Long integer	Yes		Route base year derived from Base network
SYear	Long integer	Yes		Project scenario start year
Scenario	String	Yes	0	Project scenario
TransitYear	Long integer	No		Planning year of the transit route
RunSpeed	Long integer	Yes		Place holder for bus/rail running speed in mph
LineDistance	Long integer	Yes		Place holder for total length of transit bus/rail in mile
Operator	String	Yes		Transit operator and/or owner name, e.g. WMARTA

Transit Links table

Table
TRANSITLINKS

Field name	Data type	Allow nulls	Default value	Description
OBJECTID	Object ID	No		Geodatabase record identifier
TransitRouteID	Long integer	No		Transit Route identifier
LinkID	Long integer	No		Logical network link identifier
ANode	Long integer	No		Start transit connection identifier
BNode	Long integer	No		End transit connection identifier
LinkSequence	Long integer	No		Sequence number where the link locate at a specific transit route
Scenario	String	Yes		Project scenario
TransitYear	Long integer	No		Planning year of the transit route
Operation	Long integer	No		Operation time, e.g. AM peak or off peak
SYear	Long integer	Yes		Project scenario start year

Transit Route Stops table

Table
TRANSITROUTESTOPS

Field name	Data type	Allow nulls	Default value	Domain
OBJECTID	Object ID	No		Geodatabase record identifier
TransitRouteID	Long integer	No		Transit Route identifier
Node	Long integer	No		Node identifier (TPB numbering system)
NodeSequence	Long integer	No		Sequence number where the stop locate at a specific route
Operation	Long integer	No		Operation time, e.g. AM peak or PM peak
StopFlag	Short integer	No	0	Stop or non-stop (0=Stop, 1=Non-Stop)
SourceYear	Long integer	Yes		Route base year derived from Base network
Scenario	String	Yes		Project scenario
TransitYear	Long integer	No		Planning year of the transit route

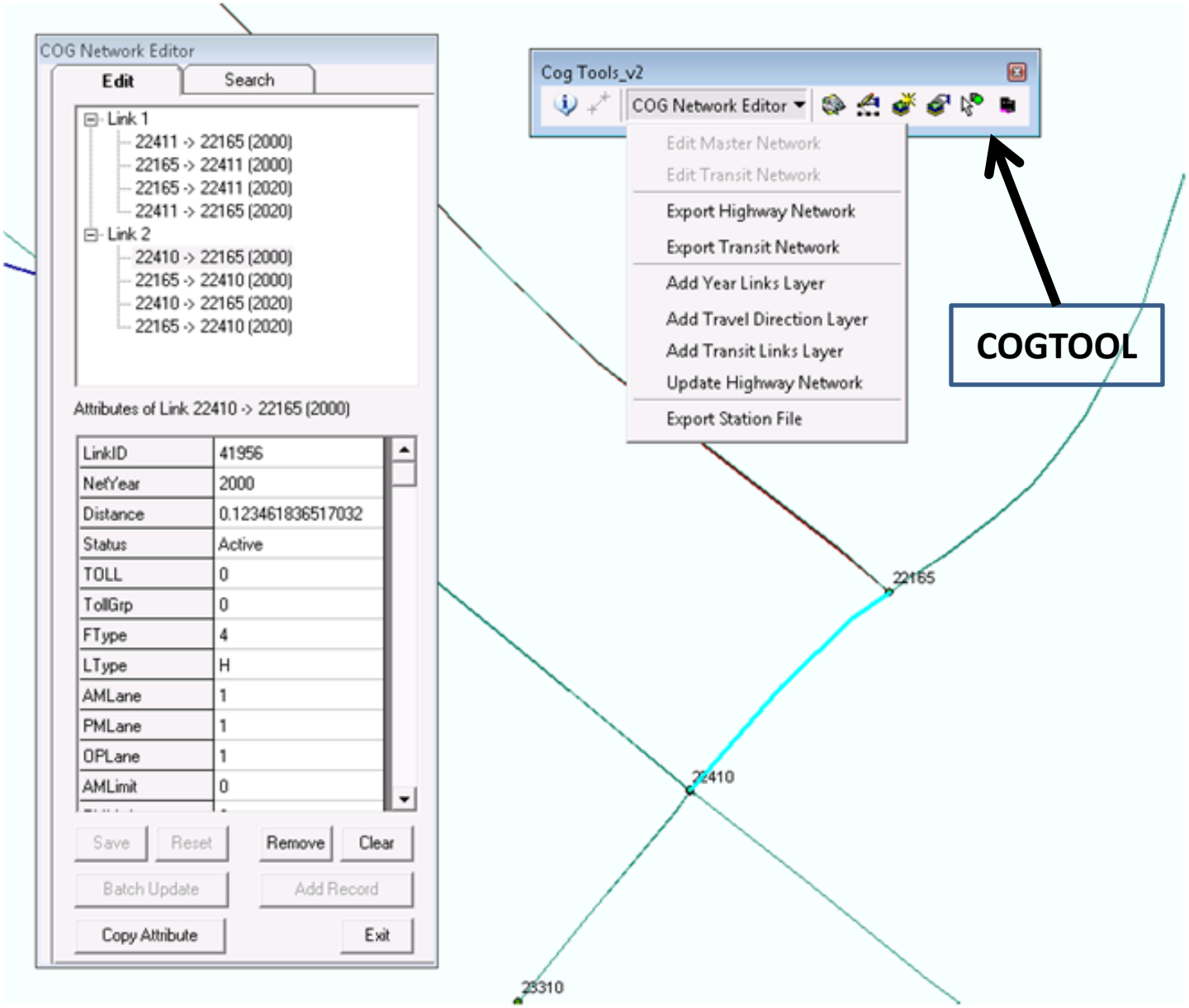
COG/TPB network editing application (COGTool)

- Highway network editing
  - Editing attributes , e.g., lane number, facility type
  - Add new links
    - Create manually by clicking and dragging mouse
    - Create and conflate link based on NAVTEQ map base
  - Split existing links
  - Remove existing links

- Transit network editing
  - Add new transit route or remove transit route
  - Modify transit route alignment
  - Edit attribute of existing transit route, e.g., headway, running time

- Exporting file (year must be specified)
  - Export highway network either in Cube-recognized PGBD format or DBASE IV format(link dbf and node dbf)
  - Export all transit mode files and support files as well as station file

COG/TPB Network editing tool (screen shot)



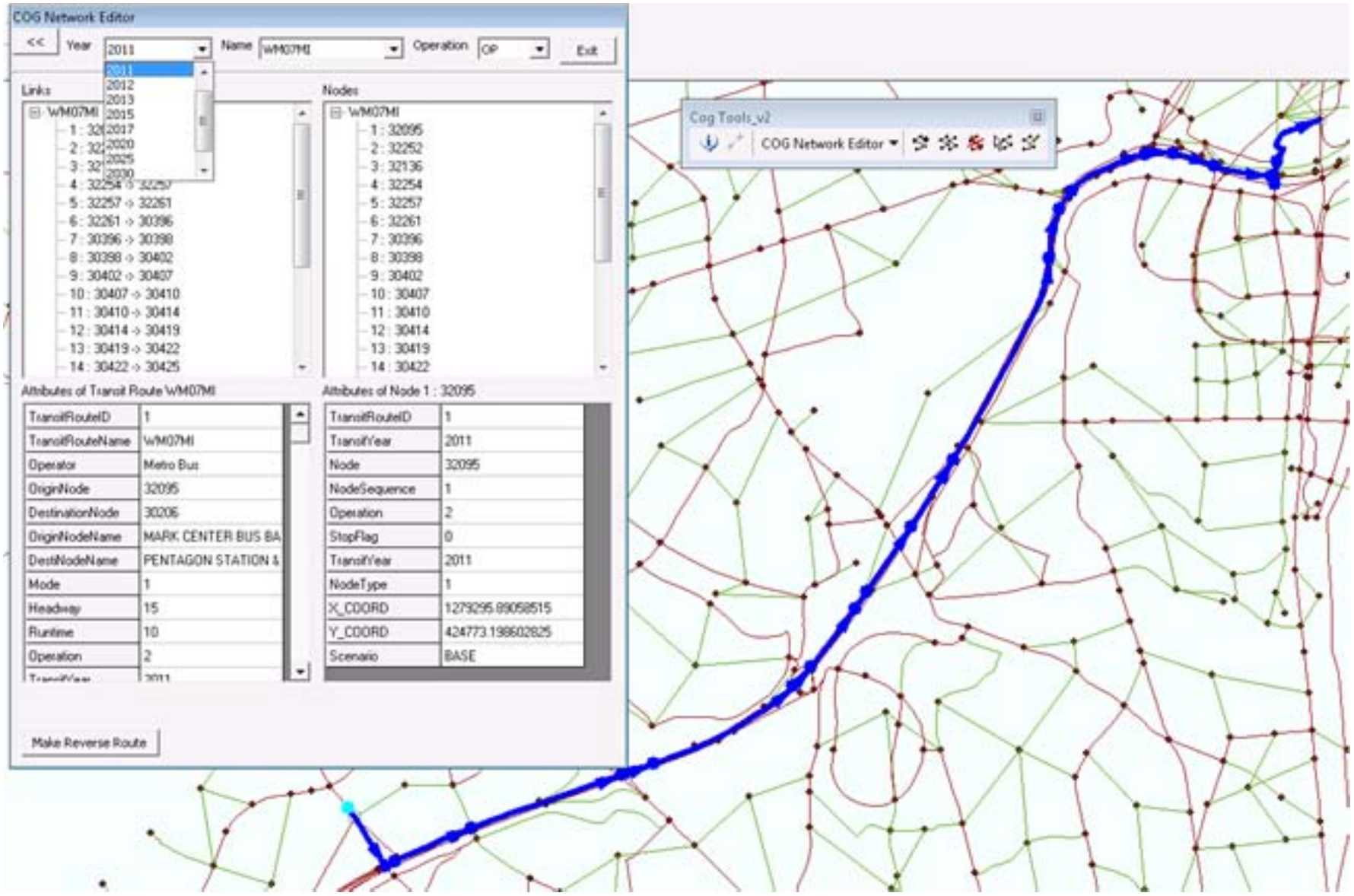
Link with EdgeID =1 in the database

EdgeID	LinkType	ANode	BNode	Oneway	Ramp Flag	Screen	JUR	Length	Shape_Length
1	1	22410	22165	1		0	1	0.12	651.8784968

Link ID	Edge ID	ANode	BNode	Distance	Link Type	Mode	TOLL	TollGrp	FType	LType	AType	AM Lane	PM Lane	OP Lane	AM Limit	PM Limit	OP Limit	Screen	Net Year	Project ID	ZoneID	Status	Jur	Count	Speed
26990	1	22165	22410	0.12	1		0	0	4	H	7	1	1	1	0	0	0	0	2000		556	1	1		
41956	1	22410	22165	0.12	1		0	0	4	H	7	1	1	1	0	0	0	0	2000		556	1	1		
39735	1	22165	22410	0.12	1		0	0	4	H		3	3	3	0	0	0	0	2020	MS6B	556	1	1		
60125	1	22410	22165	0.12	1		0	0	4	H		3	3	3	0	0	0	0	2020	MS6B	556	1	1		

Node	NodeType	Jur	X_COORD	Y_COORD	Name
22165	1	1	1264819.65	539815.575	
22410	1	1	1264359.37	539357.508	

COG/TPB Transit network editing tool (screen shot)



Transit route WM07MI in the database

Transit Route ID	Transit Route Name	Origin Node	Destination Node	Origin Node Name	Destination Node Name	Mode	Headway	Run time	Operation	Scenario	Transit Year	SYear	Run Speed	Line Distance	Operator
1	WM07MI	32095	30206	MARK CENTER BUS BAY C	PENTAGON STATION & BUS BAY U6 HOV	1	15	10	2	BASE	2011	2011			WMATA

Transit Route ID	Link ID	ANode	BNode	Link Sequence	Scenario	Transit Year	SYear	Operation
1	52338	32095	32252	1	BASE	2011	2011	2
1	22156	32252	32136	2	BASE	2011	2011	2
1	59527	32136	32254	3	BASE	2011	2011	2
1	66148	32254	32257	4	BASE	2011	2011	2
1	66151	32257	32261	5	BASE	2011	2011	2
1	66358	32261	30396	6	BASE	2011	2011	2
1	28049	30396	30398	7	BASE	2011	2011	2
1	66364	30398	30402	8	BASE	2011	2011	2
1	65412	30402	30407	9	BASE	2011	2011	2
1	65413	30407	30410	10	BASE	2011	2011	2
1	28051	30410	30414	11	BASE	2011	2011	2
1	66372	30414	30419	12	BASE	2011	2011	2
1	66575	30419	30422	13	BASE	2011	2011	2
1	66576	30422	30425	14	BASE	2011	2011	2
1	37937	30425	30428	15	BASE	2011	2011	2
1	66580	30428	30433	16	BASE	2011	2011	2
1	28853	30433	30436	17	BASE	2011	2011	2
1	51011	30436	30439	18	BASE	2011	2011	2
1	57810	30439	30443	19	BASE	2011	2011	2
1	66583	30443	30355	20	BASE	2011	2011	2
1	68549	30355	30352	21	BASE	2011	2011	2
1	74054	30352	30351	22	BASE	2011	2011	2
1	36929	30351	30206	23	BASE	2011	2011	2

Transit Route ID	Node	Node Sequence	Operation	Stop Flag	SYear	Scenario	Transit Year
1	32095	1	2	0	2011	BASE	2011
1	32252	2	2	0	2011	BASE	2011
1	32136	3	2	1	2011	BASE	2011
1	32254	4	2	1	2011	BASE	2011
1	32257	5	2	1	2011	BASE	2011
1	32261	6	2	1	2011	BASE	2011
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1	30352	22	2	1	2011	BASE	2011
1	30351	23	2	1	2011	BASE	2011
1	30206	24	2	0	2011	BASE	2011

COG/ TPB Network editing activities

- Given the importance and regularity of the COG/TPB annual air quality conformity studies, network development has evolved into a cycle of activities each year
  - Future highway networks are updated on a year-by-year basis, based on program submissions received from state and local transportation agencies.
  - Base-year transit network schedules and alignment are updated in the COG PGDB based on the latest General Transit Feed Specification (GTFS) data and paper transit schedules provided by the transit providers. Base-year updates propagate into forecast years.

COG/TPB PGDB process challenges

- COGTOOL must be added to ArcGIS platform
- Documentation of COGTOOL is still in development
- COGTOOL is still evolving to fit new requirements and changes
- User must be familiar with ArcGIS platform and its associated functions
- Understanding of basic concepts of relational databases are recommended

Conclusions

- Documentation of existing 2012 CLRP networks is underway
- Networks supporting a migration from TRNBUILD to PT networks are in development
- INRIX geo-reference codes are being related to the regional highway networks