Synchronize Our Modified Data with the Latest Vendor Update

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Abstract

The ability of Veolia Water Indianapolis to generate routes from destination addresses relies on having the most current and complete street data available. We edit our data whenever we find our NAVTEQ street data inadequate to geocode sufficiently. A data synchronization problem arises when NAVTEQ releases a new quarterly update that may not include the edits that we have made during the quarter. We have successfully implemented a process using the MapMerger Detective ArcMap extension to resolve conflicts between our edited data and the latest NAVTEQ quarterly update. This extension identifies where features have been added, moved or deleted and where attribute values have changed. We review each conflict and choose which version to keep. Changes in the Link ID unique identifier are documented so that we can repair relationships to the NAVTEQ data from our associated tables.

Background

Veolia Water Indianapolis is public-private partnership between the City of Indianapolis and Veolia Water Indianapolis, LLC. The waterworks system serves Indianapolis, Marion County and portions of eight other counties in central Indiana. Veolia Water is responsible for 12 water treatment plants, 18 pumping stations and 15 water storage tanks. The company maintains more than 4,000 miles of water main and 32,000 fire hydrants. The company's Customer Service Center answers calls for the approximate 280,000 customers. meter readers read bi-monthly and field servicemen perform 600 to 800 work orders each day. Up until recently customer growth has been approximately 6000 per year. The Water System has used GIS since 1993 for system features and customers were added but not completed by 2003. A process was put in place in 2003 that added potential customers in new developments as the water pipes were added.

Both the meter readers and the field servicemen are union and work under a unique "Standard Days Work or SDW" contract that allows them to go home once their work is complete. Time studies were performed for all work, a quality measure is in place for both groups and a growth limit is included for the meter reading routes. It is management's responsibility to dispatch a "Standard Days Work" each day for the field servicemen and create the same for meter reading routes. Because walking and driving time are the largest component of the SDW it is important that the company has a good tool to estimate its value. Currently ArcLogistics an ESRI product is being used for field service routing and the meter reading routes were developed manually using a map wheel, accurate GIS plots and excel. The routes have not been reevaluated and updated since 2000. RouteSmart an ESRI third-party extension from RouteSmart Technologies, is in the process of implementation to address the redesign of the meter reading routes and potentially the field service routing. Geolocating every customer and service call is necessary for RouteSmart to do its create new routes.

Using Geolocation at a Water Utility

Locating customers and facilities is not a new concept for the utility but using geo-coding technology to locate them is. Currently customers are located by getting GIS parcels from the county gis systems and either matching addresses or manually placing the feature. GPS is used for water system features such as pipe, valves and hydrants. Approximately 53,000 customers were not mapped prior to the beginning of Routesmart implementation. These needed to be mapped for meter reading route re-design as well as field service work order routing. We also had a need to be able to route service calls that were not customer based. This last need came from a state mandated requirement to field locate the utility facilities for the "One Call System or Call before you dig". The utility recently implemented another ESRI third-party extension (DigSmart) to locate, review and dispatch these "One Call" tickets using the GIS features to reduce field visits. The utility also needed to be able to route system facilities for efficiency.   Each of these needs require an accurate centerline GIS that can be used to geocode and develop routes.

Applications requiring Geolocation

Meter reading route re-design using RouteSmart required that all customer locations be mapped. Because we had access to accurate county GIS data we decided to geolocate as many of the 53,000 customers without location prior to importing them into RouteSmart for meter route design. This process was very successful and was able to geolocated all but 400 customers, which we are manually locating. The RouteSmart system uses geocodable and routable centerline system to create routes. The system uses modified ArcMap tools to geocode imported customer locations. Should the geocoding service not be able to geocode there are tools to use imported x, y if available.   When these tools are used it is important that the location is close to the centerline to infer connection.   It is also necessary that there be a centerline to connect the customer to. In this case new centerlines must be able to be added. Proximity to centerlines is how the system routes features like hydrant and valves. Routing the One Call tickets introduced another problem in that the zip code is not a data field the township is.

The Problem

Finding a centerline dataset to use for these needs was complicated by the fact that the entire service area included counties that did not have a routable centerline. They generally had a geocodable centerline but the routing attributes were only available for one county. Purchasing a centerline system was seen to be the only solution. However no matter how good the available systems are they would require updates of at least the new developments. Routesmart supports both Tele-Atlas and Navteq datasets.

The Solution

The decision was made to purchase Navteq for the service area which covers 50 square miles around Indianapolis. Once the dataset was delivered it would be compared to an overall gis map of our pipes to see how much needed to be added. A default template will need to be created for adding the new centerlines. The utility requires that developer plans be delivered geolocated. The centerlines are included but without geocodable or routable attributes however in most cases the data can be gathered from the parcel information. It will be important to keep the added centerline identified for when the next quarterly update is received.

Creating New Centerlines

The process for creating new centerlines is to import the delivered dataset into AutoCAD our CAD program. Then it is necessary to attach the other available datasets from all the counties in our service area in case the required centerline was available from them. Our goal is to use the owners (Counties) GIS data whenever possible.   Then attach the utilities proposed project dataset so that any new developments drawings could be used for new centerlines. The needed centerlines were identified by using the Routesmart system that will upon import list those service locations that were not geocoded but had geolocations (x, y).

Where to get the attributes

During the addition of the centerline the attributes must be added. As mentioned earlier county data is used if possible, the drawing for the new development may have the information. We also used a product from Semaphore Corporation called ZIPPlus that is a CASS certification application. This application identifies the address ranges, correct spelling of the street name and zipcodes for a given street. This software is used by many companies to receive discounts for postal mailing which requires standardized addresses to qualify. Unfortunately we also need to guess.

L_ADDRSCH	E	O
L_CITY	INDIANAPOLIS	INDIANAPOLIS
L_NREFADDR	8498	8469
L_POSTCODE	46240	46240
L_REFADDR	8470	8461
R_ADDRSCH	O	E
R_CITY	INDIANAPOLIS	INDIANAPOLIS
R_NREFADDR	8499	8468
R_POSTCODE	46240	46240
R_REFADDR	8471	8460
ST_NAME	UNION CHAPEL RD	UNION CHAPEL RD
ST_NM_BASE	UNION CHAPEL	UNION CHAPEL
ST_NM_SUFF		
ST_TYP_AFT	RD	RD

Compare Against National Dataset

Our initial review compared the Navteq Q32007 to our service area. We had 200 new projects in 2006 , 170 projects in 2007. The datasets are delivered from Navteq to RouteSmart every quarter and it takes about a month to receive it from them. And we have to keep in mind that Navteq and Teleatlas are mapping the entire county if not the world. They both have launched initiatives to get updated data from the owners but it is a huge undertaking.   It takes a visual inspection every time we received an update which would take at least 4-8 hours to complete then the modifications would have to be done to get the dataset accurate for routing.   The last dataset required 765 new street segments to be added to our service area which has 150000 street segments. We are submitting these changes to our local Navteq office each delivery in order to support their update process.   We need to see if this process could be automated.
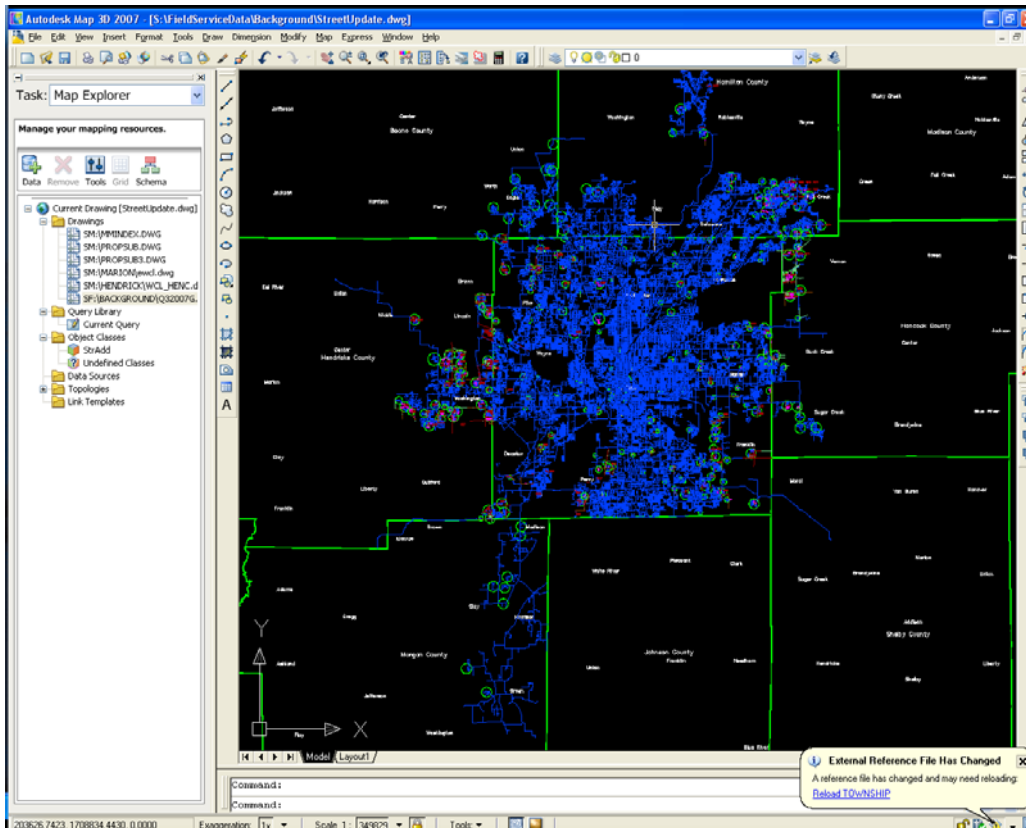

Requirements for automating the review

To automate the review and modify process we needed to be able to compare the modified map with the newly delivered map update. The comparison needed to detect data changes between the same attribute fields. There would need to be a method to detect centerline geometry change. The software would have to be able to display the detected geometry and the attribute changes along with the old data. Any additions not in to old dataset would need to be added which would require editing the old to insert the new. It would be necessary for the operator to be able to choose which to keep the old or the new. And any changes must be kept identified for the next update. RouteSmart knew our pain and had been working with another ESRI Third-Party developer who had a product that might provide this level of automation. Because of the potential of this product we were introduced to ESEA and became a beta tester for their new MapMerger Detective product.

How MapMerger Detective works

MapMerger Detective and it's bigger brother MapMerger Pro work be comparing graphics and attributes from 2 sources and displaying the comparison is such a way as to allow a human to choose which to use. The difference between MapMerger Detective and MapMerger Pro is that Detective can only compare similar datasets with the same attributes fields where Pro has tools to map datasets.   Our needs allow us to use MapMerger Detective.

The process is straight forward for such a complicated activity. You bring into ArcMap the two features to be compared. The existing is called the source and the new map update is called the new streets.
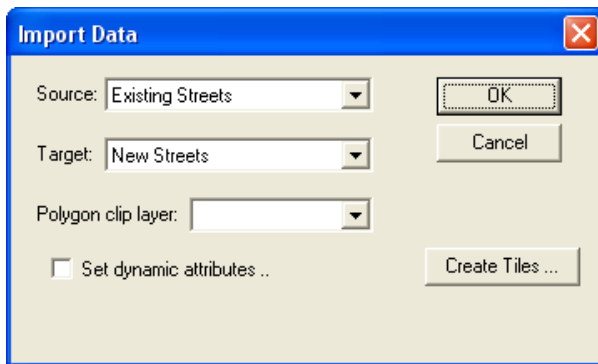
You are given the opportunity to point the compare to attributes that might have conflicts.
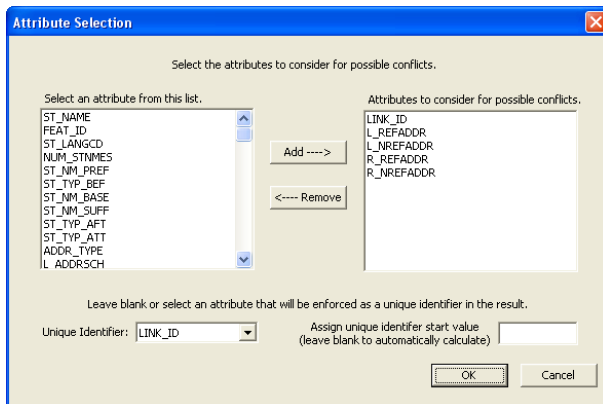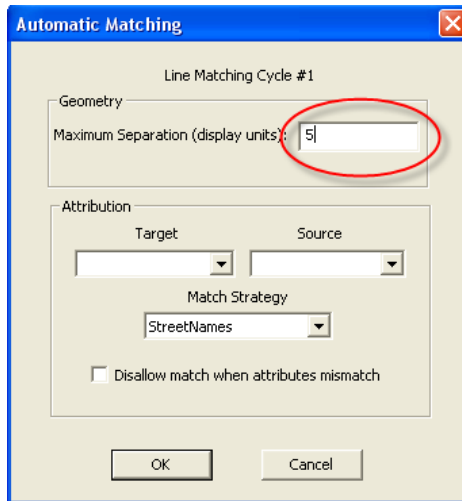
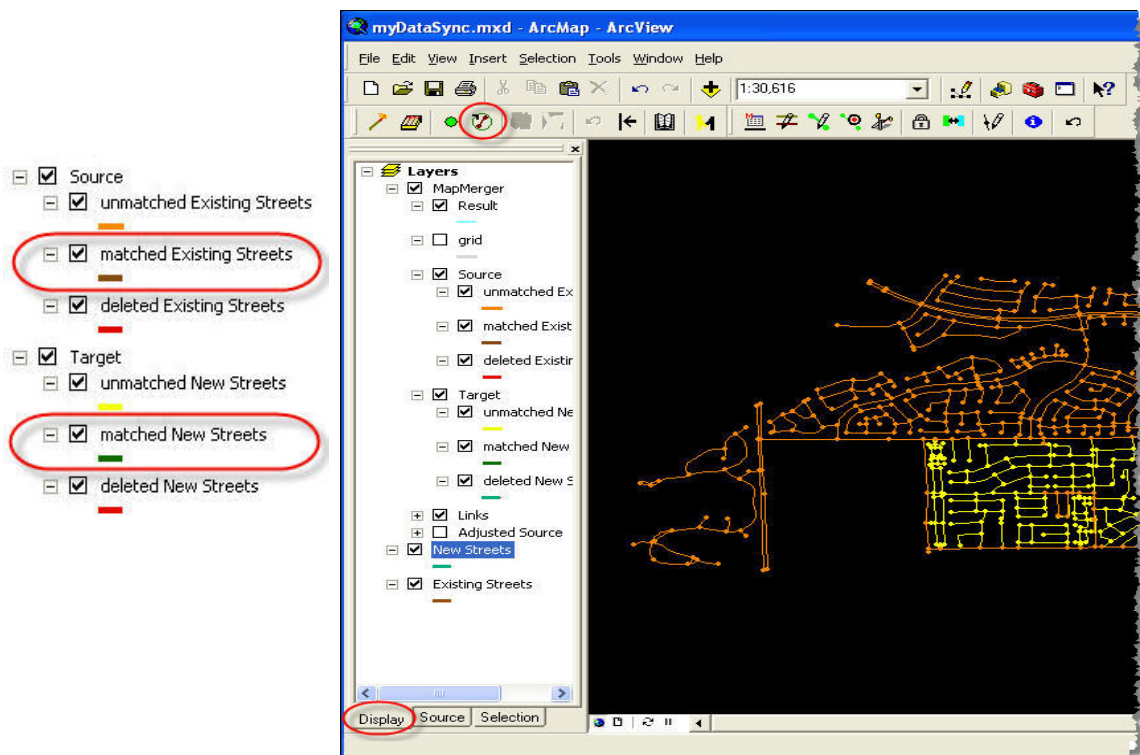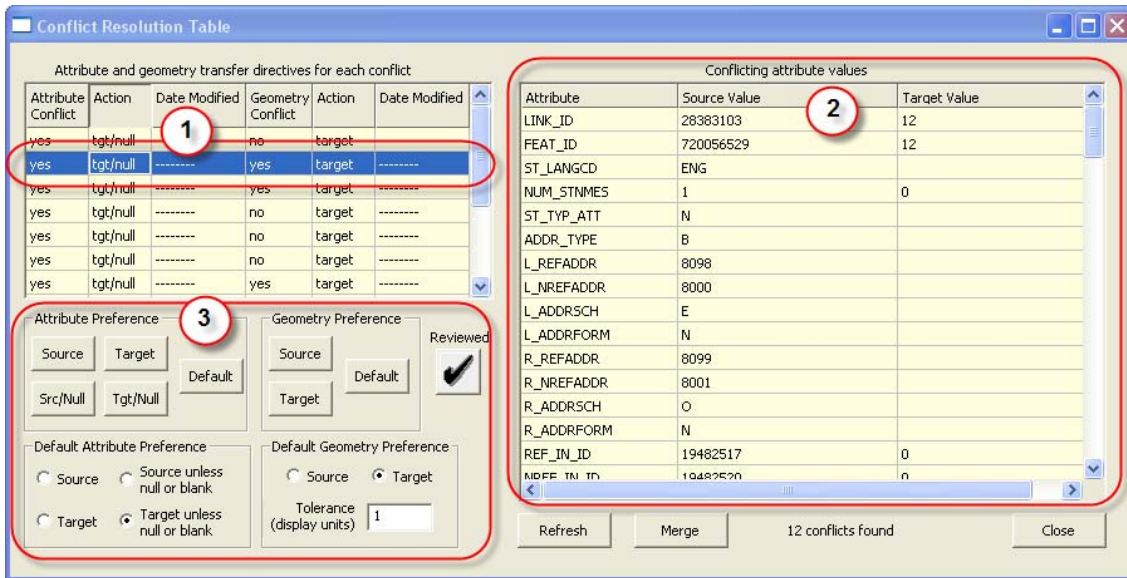Geometry is compared based on a setting.

Because visual inspection is necessary the Detective displays the changes it has found. This then becomes a process to view each interaction and choose which one should be kept.

The reconciliation process is supported by the application by offering every different option.

Conflict Resolution Table

Attribute and geometry transfer directives for each conflict

Attribute Conflict	Action	Date Modified	Geometry Conflict	Action	Date Modified
yes	tgt/null	--------	no	target	
yes	tgt/null	--------	yes	target	--------
yes	tgt/null	--------	yes	target	--------
yes	tgt/null	--------	no	target	--------
yes	tgt/null	--------	no	target	--------
yes	tgt/null	--------	no	target	--------
yes	tgt/null	--------	yes	target	--------

Conflicting attribute values

Attribute	Source Value	Target Value
LINK_ID	28383103	12
FEAT_ID	720056529	12
ST_LANGCD	ENG	
NUM_STNMES	1	0
ST_TYP_ATT	N	
ADDR_TYPE	B	
L_REFADDR	8098	
L_NREFADDR	8000	
L_ADDRSCH	E	
L_ADDRFORM	N	
R_REFADDR	8099	
R_NREFADDR	8001	
R_ADDRSCH	O	
R_ADDRFORM	N	
REF_IN_ID	19482517	0
NREF_IN_ID	19482520	0

Attribute Preference: Source | Target | Src/Null | Tgt/Null | Default

Geometry Preference: Source | Target | Default

Reviewed ✔

Default Attribute Preference:
○ Source ○ Source unless null or blank
○ Target ⦿ Target unless null or blank

Default Geometry Preference:
○ Source ⦿ Target
Tolerance (display units) 1

Refresh | Merge | 12 conflicts found | Close

1. List of streets that have an attribution or geometry difference

2. List of conflicting attributes.

3. Specify which version to keep.

Process outcome

The inputs for our first evaluation using this product were the new streets we thought we needed to add. This list was gathered by visually comparing the existing Navteq data against our pipe feature dataset. We used these streets gathered from our design drawings as the source and the new delivery from Navteq as the target. We set the compare distance to 30 feet and chose to accept all target except where the source didn't match. For a 50 square mile area having 240000 centerlines it took 30 minutes to get the result. The Detective tool assigns an unique link_id to added centerlines if necessary. The tool allows you to set the starting number so that you can identify the new centerlines for the next update. We are also submitting the new centerlines to Navteq for their use in updating the centerline data. We were very satisfied with how the tool works and how it saves us time after each delivery. We used this process to validate the time savings in order to purchase this tool in the near future.

Accurate/Current Centerlines My Personal Rant

The amount of update required displays how important it is for every public private owner/creater/user of centerline data to be active in promoting centerline update. Both Navteq and Teleatlas have web sites for making changes to their datasets. Both are actively contacting and are some cases using datasets they receive from local cities, municipalities and in some cases states. We can all also promote centerline

standardization that includes routing attributes.

Centerlines are the basic framework layer that supports Public Safety, Economic Development and Service delivery and they are being used by everyone using the web mapping systems, as GPS background and now mobile phones. If you want some to find you on your street whether it be a business or a residence the street centerline with the correct address range must be correct on the national datasets no matter what the vendor.