Appendix D – Centerline/MSAG Reconciliation

Purpose and Summary

It's the purpose of this document to detail a method for rectifying road centerline data (RCL) with the 911 Master Street Address Guide (MSAG). The method outlined in this document is significantly more efficient than what's outlined in NENA 71-501, Version 1, "NENA Information Document for Synchronizing Geographic Information System Databases with MSAG & ALI" and will be utilized by Hancock County as our de facto methodology until such a time as NENA updates NENA 71-501 or a better methodology is established.

The process is broken down into a series of steps described below. These include preparing a copy of the MSAG, geocoding low and high MSAG address ranges and mapping each MSAG segment to the RCL. Hancock County is currently relying on Caliber Public Safety as our CAD vendor and uses ArcGIS 10.3.1 for creation, maintenance and analysis of local GIS data. The workflow detailed in this document will demonstrate the rectification of the two data sources using ArcGIS 10.3.1 and assumes some familiarity with ESRI software.

Preparing the MSAG

To begin**, export a copy of the 'Msag'** table from the 'IACAD' database to your workspace. Remove all the extraneous fields and data you won't need. This includes all rows with a *TenantID* **value that isn't equal to 'PK:TDefault', all rows with a** *IsRecordActive* **value of 'FALSE', fields** *C1* **through** *C20***, as well as fields** *State***,** *LastModifiedTimestamp* **and** *IsRecordActive* **after all FALSE rows have been removed. Remove all records with a** *StreetName* **value of 'MM something' (mile marker). Remove all records that have a** *HouseNumLow* **or** *HouseNumHigh* **value of '0'.**

Next, import the copy of the MSAG into a file geodatabase and add the imported copy to ArcGIS. We'll leverage ArcGIS to further prepare the MSAG for geocoding. The Caliber CAD system doesn't use zip to validate addresses so in most cases this field isn't populated in the Caliber MSAG. However, we'll need zip code to geocode the MSAG and because the CAD system uses postal community to validate addresses, we can use the corresponding zip code as a proxy to find postal community discrepancies between GIS and CAD. We can quickly calculate zip code using the field calculator in ArcGIS.

To do so, start an edit session and select the table you imported as the target. **Select every row with the same value in the 'Community' field** (which represents postal community) then perform a **field calculation in the** *Zip* **field to set it equal to the postal community zip code**. Remember to hit the 'show selected records' button in the attribute table. If you're unsure what the zip code should be you can find it online at https://tools.usps.com/go/ZipLookupAction!input.action. Choose 'Find by City & State.'

After you've finished populating zip code values save your edits and end the edit session. Then add three new fields to the table, *FULL_ST_NM* (Text, Length 50) *LOW_ADD* (Text, Length 50)), and *HIGH_ADD* (Text, Length 50). *FULL_ST_NM* will be used to calculate the full street name, *LOW_ADD* and

HIGH_ADD will be used to calculate the low and high address ranges as independent addresses so we can geocode these values.

The next step in prepping the MSAG is to populate the FULL_ST_NM field. This can be done by leveraging the field calculator again. Make sure the parser is set to VB Script and calculate FULL_ST_NM as being equal to

Trim([PrefixDirectional] & " " & [StreetName] & " " & [StreetType] & " " & [PostDirectional])

The field names in your MSAG will probably vary from what's shown above. The Trim function should clean up any extra spaces that may be left. If for some reason it doesn't you can use the replace function for final clean up. For example, switch your parser to Python and calculate

!FULL_ST_NM!.replace("whatyouwantchanged", "whatyouwant")

After *FULL_ST_NM* is populated for all records calculate *LOW_ADD* as being equal to

[HouseNumLow] & " " & [FULL_ST_NM]

And *HIGH_ADD* equal to

[HouseNumHigh] & " " & [FULL_ST_NM].

and you're done prepping the MSAG table.

Geocoding MSAG Low and High Address Ranges

If you don't already have an address locator based on your RCL data created then create a new Feature Dataset inside the File Geodatabase you used to import the MSAG table and import your RCL into it. Create a new address locator using the RCL data you imported. Use 'US Address – Dual Ranges' as the style. RCL in the Caliber schema should autofill the fields in the ESRI geocoder correctly.

Add the Address Locator to ArcMap and the RCL data if you haven't already. Add the geocoding toolbar if it's not already in your map project. Hit the **Geocode Addresses button and select the Address Locator you just created. Use *LOW_ADD* as your Street and *Zip* as your ZIP Code field.** Click Geocoding Option. Both **'Side offset' and 'End offset' should be set to zero. Check 'X and Y coordinates'**. Click OK and then OK once more to geocode the low range of the MSAG. Unmatched and some tie results indicate a discrepancy. Export the output to your working folder and name it something intuitive. Add the exported results to the map and remove the original results. **Go through this same process again using *HIGH_ADD* as your street when geocoding.**

Before mapping the MSAG to the RCL data try to clean up as many discrepancies as you can. The two more common issues will be incorrect address ranges which you'll notice more often in the RCL data and Zip Code which translates to a discrepancy between the *Community* field in the MSAG and the *COMM_L* and *COMM_R* fields in the RCL data. The CAD system begins address validation by narrowing allowable results down to the *Community* value inside the MSAG. For example, if a caller's address falls inside a

MSAG segment that has a *Community* value of 'Fortville' then it will look for the closest street name match in the RCL that has a *COMM_X* value of Fortville. When *COMM_X* has a different postal community value than the MSAG it will be ignored by the CAD system even if the GIS record is otherwise a perfect match.

Another frequent issue is related to zip code breaks being in the RCL but not being in the MSAG. Technically, so long as what's in the GIS matches what's in the MSAG an address will map correctly. Whether 911 will want to break the MSAG into little pieces by postal community may vary from jurisdiction to jurisdiction depending on circumstances. Remaining issues are largely confined to alias names and missing street directional, once again how a jurisdiction wants to deal with these may vary.

After discrepancies have been resolved recreate the address locator based on the updated RCL data, prep the MSAG once more using the updated version and geocode the MSAG to your RCL again. This will pick up any discrepancies you missed or may have created when updating records. Rinse and repeat until you're satisfied most of the issues between the MSAG and RCL data have been resolved.

Mapping MSAG Segments to the RCL Data

We'll use the field *MsagId* to join the low and high MSAG address range results. Before we do that we need to **add the fields *X1* (Double) and *Y1* (Double) to the output of the high address range results. Calculate each of these as being equal to the corresponding *X* and *Y* fields that ArcGIS populated in the geocoding results**. This is necessary because we can't use the same field name for the X and Y fields in both outputs when we use the 'XY to Line' tool in ArcToolbox. After you've done this go ahead and perform the **join between the low and high range geocoding outputs based on *MsagId***.

After the join is completed go to ArcToolbox→Data Management Tools→Features→**XY To Line. Your Input Table is the table you used to create the join. Use the *X* and *Y* fields from the low range geocoding output and the *X1* and *Y1* fields you populated in the high range geocoding output.** Then hit OK. Change the name of the output to something intuitive.

Even if you've cleaned up most of your discrepancies you'll probably have some lines that draw way off the map. Start an edit session and delete them then save and end the edit session. These are indicative of a problem but leaving them on the map just clutters it and doesn't help to identify the problem. An easy way to visualize where these problems are is to change the color of the RCL data to something that pops out like red and lay the MSAG map on top of it and change it to something neutral like gray. Where you see the red lines with no gray lines more or less covering them are the problem areas. MSAG lines that connect from one RCL to another far away are most likely indicative of an ambiguity. Once you clean up these remaining issues you should have a fairly solid synchronization between your RCL and MSAG data. An example map from Hancock County, IN that hasn't been cleaned up yet is below. Gray is MSAG. Red is RCL.