

# Macro Method to use Google Maps™ and SAS® to Geocode a Location by Name or Address

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## ABSTRACT

Google Maps™ is a very useful tool in finding driving directions between addresses and defining a geographic representation of an address (geocoding) which can be used in many applications in research. Using macro and data step SAS® code, the latitude and longitude of a location can be found by searching the html code resulting from a Google Maps™ search, which can be developed using SAS® v9.3 for Windows®.

## INTRODUCTION

The methods introduced will allow a SAS® Programmer, with basic SAS® programming skills, to use Google™ and SAS® to isolate the latitude and longitude of any location by name or address search in Google Maps™.

## FORMAT LOCATIONS AND ADDRESSES FOR GOOGLE MAPS™

The source SAS® data set contains a record number (RecNum) identifier, a Hospital Name, and its address. Both the Hospital Name and Address will be used for the Google Maps™ search and will need to be formatted to remove any special characters and add plus (+) signs as spaces. The code also counts the number of observations in the data set for later use in the macro execution.

RecNum	Hospital Name	Hospital Address
001	Access Hospital Dayton - Dayton	2611 Wayne Ave, Dayton, OH 45420
002	Barnesville Hospital - Barnesville	639 W Main St, Barnesville, OH 43713
003	Christ Hospital - Cincinnati	2139 Auburn Ave, Cincinnati, OH 45219
004	Dayton Children's Medical Center - Dayton	1 Childrens Plaza, Dayton, OH 45404
005	East Liverpool City Hospital - East Liverpool	425 W 5th St, East Liverpool, OH 43920
006	Fairfield Medical Center - Lancaster	401 N Ewing St, Lancaster, OH 43130
007	Good Samaritan Hospital - Cincinnati	375 Dixmyth Ave, Cincinnati, OH 45220
008	Harrison Community Hospital - Cadiz	951 E Market St, Cadiz, OH 43907
009	Indu and Raj Soim Medical Center - Beavercreek	3535 Pentagon Blvd, Beavercreek, OH 45431
010	Jewish Hospital - Kenwood	4777 E Galbraith Rd, Cincinnati, OH 45236
011	Kettering Behavioral Medicine Center - Kettering	5350 Lamma Rd, Dayton, OH 45439
012	Lake Health	7590 Auburn Rd, Painesville, OH 44077
013	Madison Health - London	210 N Main St, London, OH 43140
014	Nationwide Children's Hospital - Columbus	700 Children's Dr, Columbus, OH 43205
015	Ohio Valley Medical Center - Springfield	100 W Main St, Springfield, OH 45502
016	Paulding County Hospital - Paulding	1035 W Wayne St, Paulding, OH 45879
017	Rainbcw Babies & Children's Hospital - Cleveland	11100 Euclid Ave, Cleveland, OH 44105
018	Saint Luke's Hospital - Maumee	5901 Monclova Rd, Maumee, OH 43537
019	The Bellevue Hospital - Bellevue	1400 W Main St, Bellevue, OH 44811
020	The Ohio State University Hospital East	181 Taylor Ave, Columbus, OH 43203
021	The Richard M. Ross Heart Hospital - Columbus	452 W 10th Ave, Columbus, OH 43210
022	The Toledo Hospital - Toledo	2142 N Cove Blvd, Toledo, OH 43606
023	Union Hospital - Dover	659 Boulevard St, Dover, OH 44622
024	Wadsworth - Rittman Hospital - Wadsworth	195 Wadsworth Rd, Wadsworth, OH 44281

## Display 1. Source SAS® data set

```

/*Adjust format of hospital name and address to be Google Maps™ friendly*/
data Hospitals (keep=RecNum Hospital_Name HospitalNm Hospaddr
Hospital_Address);
    length HospitalNm Hospaddr $200.;
    format HospitalNm Hospaddr $200.;
    informat HospitalNm Hospaddr $200.;
    set HospitalsX nobs=obsnum;
iiHospitalNm=compress(Hospital_Name,"-,&'." );
iHospitalNm=tranwrd(left(trim(iiHospitalNm))," ","+");
HospitalNm=tranwrd(left(trim(iHospitalNm)),"++","+");
iiHospaddr=compress(Hospital_Address,"-,&'." );
iHospaddr=tranwrd(left(trim(iiHospaddr))," ","+");
Hospaddr=tranwrd(left(trim(iHospaddr)),"++","+");
*Assign macro variable obsnum=number of observations;
call symput('obsnum',trim(strip(left(put(obsnum,8.))));
run;

```

RecNum	Hospaddr	HospitalNm
001	2611+Wayne+Ave+Dayton+OH+45420	Access+Hospital+Dayton+Dayton
002	639+W+Main+St+Barnesville+OH+43713	Barnesville+Hospital+Barnesville
003	2139+Auburn+Ave+Cincinnati+OH+45219	Christ+Hospital+Cincinnati
004	1+Childrens+Plaza+Dayton+OH+45404	Dayton+Childrens+Medical+Center+Dayton
005	425+W+5th+St+East+Liverpool+OH+43920	East+Liverpool+City+Hospital+East+Liverpool
006	401+N+Ewing+St+Lancaster+OH+43130	Fairfield+Medical+Center+Lancaster
007	375+Dixmyth+Ave+Cincinnati+OH+45220	Good+Samaritan+Hospital+Cincinnati
008	951+E+Market+St+Cadiz+OH+43907	Hamison+Community+Hospital+Cadiz
009	3535+Pentagon+Blvd+Beavercreek+OH+45431	Indu+and+Raj+Soin+Medical+Center+Beavercreek
010	4777+E+Galbraith+Rd+Cincinnati+OH+45236	Jewish+Hospital+Kenwood
011	5350+Lamme+Rd+Dayton+OH+45439	Kettering+Behavioral+Medicine+Center+Kettering
012	7590+Auburn+Rd+Painesville+OH+44077	Lake+Health
013	210+N+Main+St+London+OH+43140	Madison+Health+London
014	700+Childrens+Dr+Columbus+OH+43205	Nationwide+Childrens+Hospital+Columbus
015	100+W+Main+St+Springfield+OH+45502	Ohio+Valley+Medical+Center+Springfield
016	1035+W+Wayne+St+Paulding+OH+45879	Paulding+County+Hospital+Paulding
017	11100+Euclid+Ave+Cleveland+OH+44106	Rainbow+Babies+Childrens+Hospital+Cleveland
018	5901+Monclova+Rd+Maumee+OH+43537	Saint+Lukes+Hospital+Maumee
019	1400+W+Main+St+Bellevue+OH+44811	The+Bellevue+Hospital+Bellevue
020	181+Taylor+Ave+Columbus+OH+43203	The+Ohio+State+University+Hospital+East
021	452+W+10th+Ave+Columbus+OH+43210	The+Richard+M+Ross+Heart+Hospital+Columbus
022	2142+N+Cove+Blvd+Toledo+OH+43606	The+Toledo+Hospital+Toledo
023	659+Boulevard+St+Dover+OH+44622	Union+Hospital+Dover
024	195+Wadsworth+Rd+Wadsworth+OH+44281	Wadsworth+Rittman+Hospital+Wadsworth

**Display 2. Reformatted SAS® data set**

## GEOCODE BY LOCATION NAME/ADDRESS

SAS® can use Google Maps™ to find a map location given the name of the location or an address. The reformatted location name or address from the source data set is defined as a macro variable and assigned into a filename statement for a Google Maps™ url. An infile statement is used to read in the html code from the Google Maps™ search result page in 1000 character substrings. Using the FIND function, each substring is searched for the a unique character string (",[null,null,") that always precedes the latitude and longitude corresponding to the location defined and the observation is retain. The numeric latitude (lat) and longitude (long) are defined by using the SCAN function with the substring to isolate the numeric value of each. Observations with latitude/longitude pairs are appended into a data set to contain all source data corresponding pairs. Always be sure to disassociate current assigned url before the next search.

```
/*Macro to Geocode data by specified variable*/
%macro Geocode(j=,var=);
*Create datasets to append latitudes and longitudes;
data Geocode&var.X;
run;

*Create loop to access each observation;
%do i=1 %to &j;
*Assign macro variables needed;
data _null_;
set Hospitals;
if _n_=&i then do;
call symput("hosp",trim(strip(&var)));
call symput("Name",trim(strip(Hospital_Name)));
call symput("Address",trim(strip(Hospital_Address)));
call symput("RecNum",trim(strip(RecNum)));
end;
run;

/*Find Latitude and longitude in sitecode*/
*Define Google Maps url with starting addresses;
filename gmaps url "http://maps.google.com/maps?daddr=&hosp";
*Define sitecode as 1000 character parts of location html for
starting address;
data Geocode&var.&i (drop=sitecode markst);
infile gmaps recfm=f lrecl=1000 end=eof;
input sitecode $1000.;
*Find text proceeding latitude and longitude in html code for starting
address;
if find(sitecode,'"',[null,null,']) then do;
*Assign variable to starting location of proceeding text for starting
address;
markst=find(sitecode,'"',[null,null,']);
*Scan substring starting with proceeding text for starting
address latitude and longitude;
lat=input(scan(substr(sitecode,markst),4,","),best12.);
long=input(scan(substr(sitecode,markst),5,","),best12.);
length Name Address $200.;
format Name Address $200.;
Name="&Name";
Address="&Address";
RecNum="&RecNum";
output;
end;
run;
```

```

*Append observation to dataset of starting address lat/long;
data Geocode&var.X;
    set Geocode&var.X
        Geocode&var.&i;
    if lat^=.;
    label lat="Hospital latitude"
        long="Hospital longitude";
run;
proc sort data=Geocode&var.X; by RecNum; run;
*Disassociate current assigned gmaps;
filename gmaps clear;
%end;
%mend;

/*Execute Macro on each variable*/
%Geocode(j=&obsnum,var=HospitalNm);

```

Record Number	Location Name	Address	Hospital latitude	Hospital longitude
001	Access Hospital Dayton - Dayton	2611 Wayne Ave, Dayton, OH 45420	39.735918	-84.154249
002	Barnesville Hospital - Barnesville	639 W Main St, Barnesville, OH 43713	39.993111	-81.1890643
003	Christ Hospital - Cincinnati	2139 Auburn Ave, Cincinnati, OH 45219	39.1211546	-84.510667
004	Dayton Children's Medical Center - Dayton	1 Childrens Plaza, Dayton, OH 45404	39.7742909	-84.1676062
005	East Liverpool City Hospital - East Liverpool	425 W 5th St, East Liverpool, OH 43920	40.6219146	-80.5857511
006	Fairfield Medical Center - Lancaster	401 N Ewing St, Lancaster, OH 43130	39.717277	-82.5777536
007	Good Samaritan Hospital - Cincinnati	375 Dixmyth Ave, Cincinnati, OH 45220	39.139754	-84.521727
008	Harrison Community Hospital - Cadiz	951 E Market St, Cadiz, OH 43907	40.2574287	-80.9770918
009	Indu and Raj Soin Medical Center - Beavercreek	3535 Pentagon Blvd, Beavercreek, OH 45431	39.770997	-84.0626695
010	Jewish Hospital - Kenwood	4777 E Galbraith Rd, Cincinnati, OH 45236	39.2059237	-84.3812113
011	Kettering Behavioral Medicine Center - Kettering	5350 Lamme Rd, Dayton, OH 45439	39.6754421	-84.2105877
012	Lake Health	7590 Auburn Rd, Painesville, OH 44077	41.6626743	-81.2468697
013	Madison Health - London	210 N Main St, London, OH 43140	39.8924807	-83.4543884
014	Nationwide Children's Hospital - Columbus	700 Children's Dr, Columbus, OH 43205	39.9530398	-82.9795889
015	Ohio Valley Medical Center - Springfield	100 W Main St, Springfield, OH 45502	39.925385	-83.812816
016	Paulding County Hospital - Paulding	1035 W Wayne St, Paulding, OH 45879	41.1351619	-84.6022295
017	University Hospitals Rainbow Babies & Children's Hospital	11100 Euclid Ave, Cleveland, OH 44106	41.5041946	-81.6058122
018	Saint Luke's Hospital - Maumee	5901 Monclova Rd, Maumee, OH 43537	41.557113	-83.681681
019	The Bellevue Hospital - Bellevue	1400 W Main St, Bellevue, OH 44811	41.2880793	-82.8815915
020	The Ohio State University Hospital East	181 Taylor Ave, Columbus, OH 43203	39.9707494	-82.9614311
021	The Richard M. Ross Heart Hospital - Columbus	452 W 10th Ave, Columbus, OH 43210	39.9945796	-83.0184298
022	The Toledo Hospital - Toledo	2142 N Cove Blvd, Toledo, OH 43606	41.67304	-83.594991
023	Union Hospital - Dover	659 Boulevard St, Dover, OH 44622	40.5147903	-81.4556568
024	Wadsworth - Rittman Hospital - Wadsworth	195 Wadsworth Rd, Wadsworth, OH 44281	41.0278353	-81.7505084

**Display 3. Geocoding by Name of Location SAS® data set**

```
%Geocode ( j=&obsnum , var=hospaddr ) ;
```

Record Number	Location Name	Address	Hospital latitude	Hospital longitude
001	Access Hospital Dayton - Dayton	2611 Wayne Ave, Dayton, OH 45420	39.736137	-84.1536069
002	Barnesville Hospital - Barnesville	639 W Main St, Barnesville, OH 43713	39.993111	-81.1890643
003	Christ Hospital - Cincinnati	2139 Auburn Ave, Cincinnati, OH 45219	39.1211392	-84.5103541
004	Dayton Children's Medical Center - Dayton	1 Childrens Plaza, Dayton, OH 45404	39.774902999	-84.16721
005	East Liverpool City Hospital - East Liverpool	425 W 5th St, East Liverpool, OH 43920	40.6218488	-80.5861388
006	Fairfield Medical Center - Lancaster	401 N Ewing St, Lancaster, OH 43130	39.7174127	-82.57737209
007	Good Samaritan Hospital - Cincinnati	375 Dixmyth Ave, Cincinnati, OH 45220	39.1400349	-84.52067269
008	Harrison Community Hospital - Cadiz	951 E Market St, Cadiz, OH 43907	40.2572768	-80.97862599
009	Indu and Raj Soin Medical Center - Beavercreek	3535 Pentagon Blvd, Beavercreek, OH 45431	39.7709515	-84.06265139
010	Jewish Hospital - Kenwood	4777 E Galbraith Rd, Cincinnati, OH 45236	39.2058695	-84.3810129
011	Kettering Behavioral Medicine Center - Kettering	5350 Lamme Rd, Dayton, OH 45439	39.6753972	-84.21231089
012	Lake Health	7590 Auburn Rd, Painesville, OH 44077	41.6627956	-81.24655249
013	Madison Health - London	210 N Main St, London, OH 43140	39.892537399	-83.4544325
014	Nationwide Children's Hospital - Columbus	700 Children's Dr, Columbus, OH 43205	39.9530398	-82.97958899
015	Ohio Valley Medical Center - Springfield	100 W Main St, Springfield, OH 45502	39.925385	-83.812816
016	Paulding County Hospital - Paulding	1035 W Wayne St, Paulding, OH 45879	41.1351619	-84.60222949
017	Rainbow Babies & Children's Hospital - Cleveland	11100 Euclid Ave, Cleveland, OH 44106	41.5061755	-81.60501669
018	Saint Luke's Hospital - Maumee	5901 Monclova Rd, Maumee, OH 43537	41.5571451	-83.68168109
019	The Bellevue Hospital - Bellevue	1400 W Main St, Bellevue, OH 44811	41.2880793	-82.8815915
020	The Ohio State University Hospital East	181 Taylor Ave, Columbus, OH 43203	39.9707494	-82.96143119
021	The Richard M. Ross Heart Hospital - Columbus	452 W 10th Ave, Columbus, OH 43210	39.9947428	-83.01822
022	The Toledo Hospital - Toledo	2142 N Cove Blvd, Toledo, OH 43606	41.6730403	-83.5949906
023	Union Hospital - Dover	659 Boulevard St, Dover, OH 44622	40.5144394	-81.455702
024	Wadsworth - Rittman Hospital - Wadsworth	195 Wadsworth Rd, Wadsworth, OH 44281	41.0283293	-81.75112949

**Display 4. Geocoding by Address SAS® data set**

## CONCLUSION

The macro presented allows the user to find the latitude and longitude of a particular location using its name or address using SAS® and Google Maps™. A few things to note: Running this code against 24 observations takes longer than usual. If a location name is too general, it may result in multiple latitude and longitude pairs, so it is best to specify the desired region, city, or neighborhood association if multiple locations exist. For example, if a location name is 'Mercy Health' and you desire the West side location, it is best to search 'Mercy Health West'. Also, you may notice the pairs may not be exact when searching by address compared to searching by location name. Google Maps™ geocodes locations by the center of the location not necessarily by the address.

## REFERENCES

- Bekkerman, Anton, Ph.D. 2010. "Going the Distance: Google Maps™ Capabilities in a Friendly SAS Environment." [http://wuss.org/Proceedings13/100\\_Paper.pdf](http://wuss.org/Proceedings13/100_Paper.pdf)
- Zdeb, Mike. 2010. "Driving Distances and Drive Times using SAS® and Google Maps™." *Coders' Corner*. Seattle, WA: SAS® Global Forum, <http://support.sas.com/resources/papers/proceedings10/050-2010.pdf>

## CONTACT INFORMATION

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