



SAMsix

Routing Calculation System

White Paper

September 21, 2010 (v1.4)

Case Number: 6581

Summary

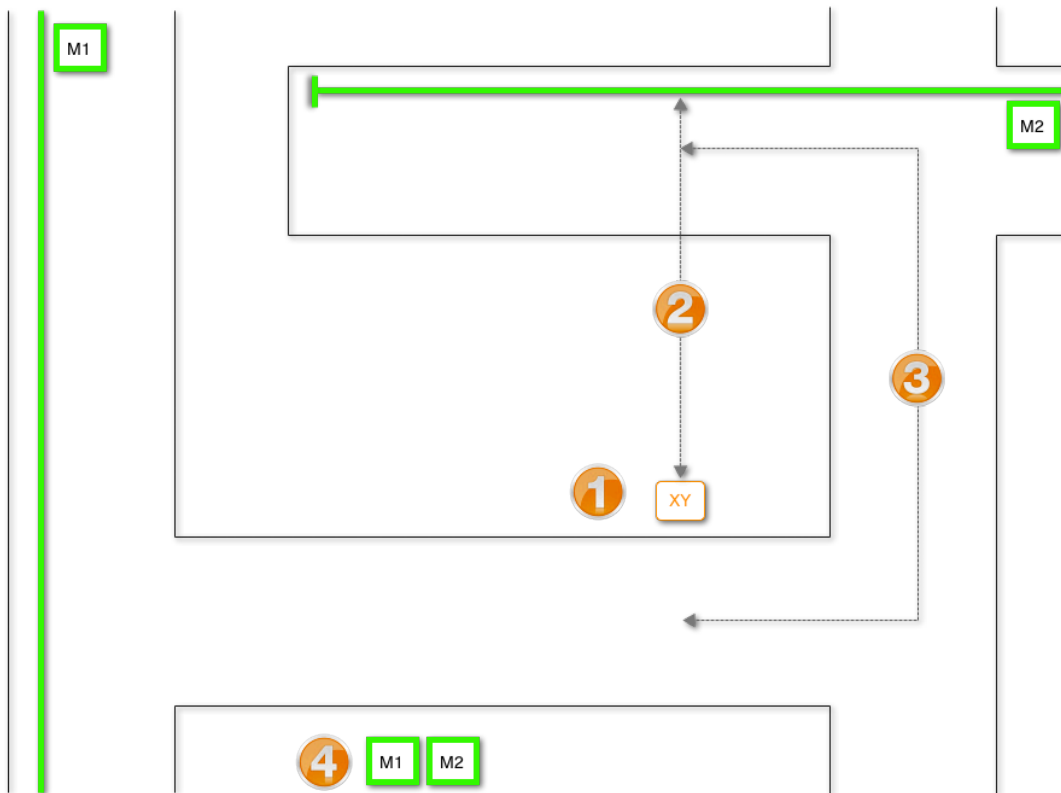
This white paper describes the design for an NRG server-based module to find the shortest route from existing gas main to any given address. The module will be used to automatically find walking distances to new customer prospects based on the location of the current gas network.

Additionally the module will stipulate if an address is on-main or not, i.e. whether an existing main is passing in front of the address.

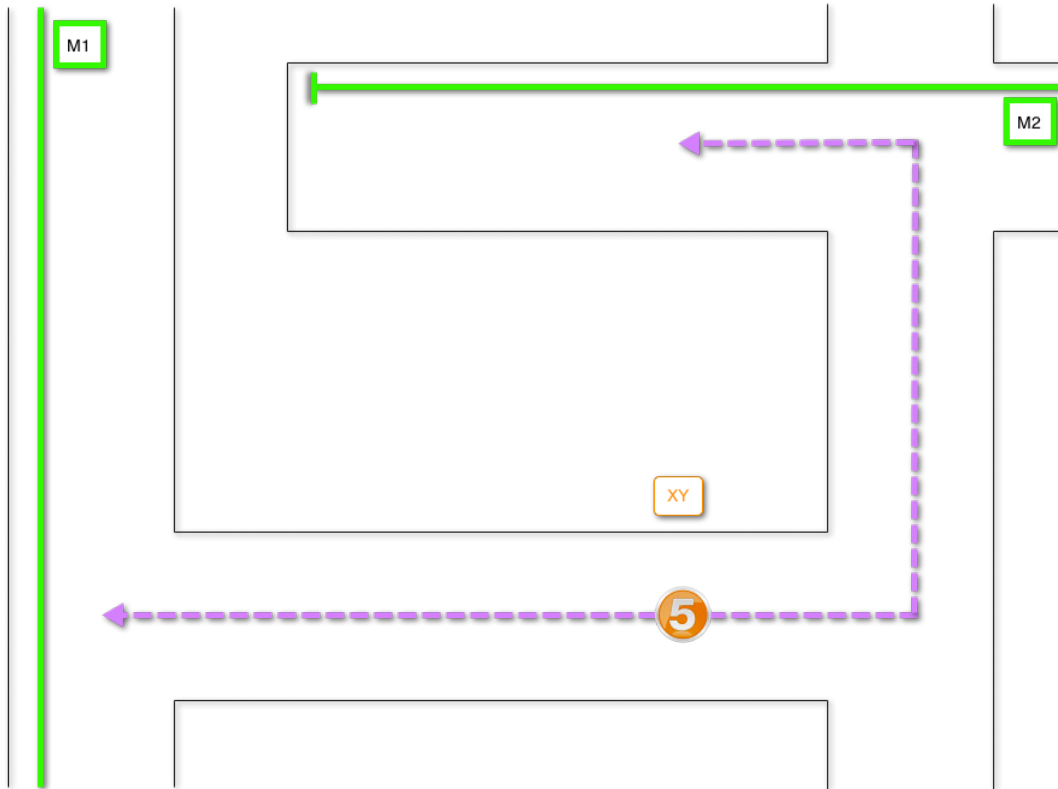
Finally a process of pre-screening the address data will be provided, to determine which addresses are definitely not on-main and which are definitely outside of a given maximum distance from any mains to be of interest. This will leave addresses close enough to existing mains to warrant full geo-coding and routing. Addressing services, whether sourced in-house or externally can take a few seconds per enquiry: that translates into many days of server run-time for a million addresses. Pre-screening the data will ensure only records worth looking into will be processed.

The module will populate a relational database table that may then be used for reporting or linking to other corporate databases for comparisons or direct record updates.

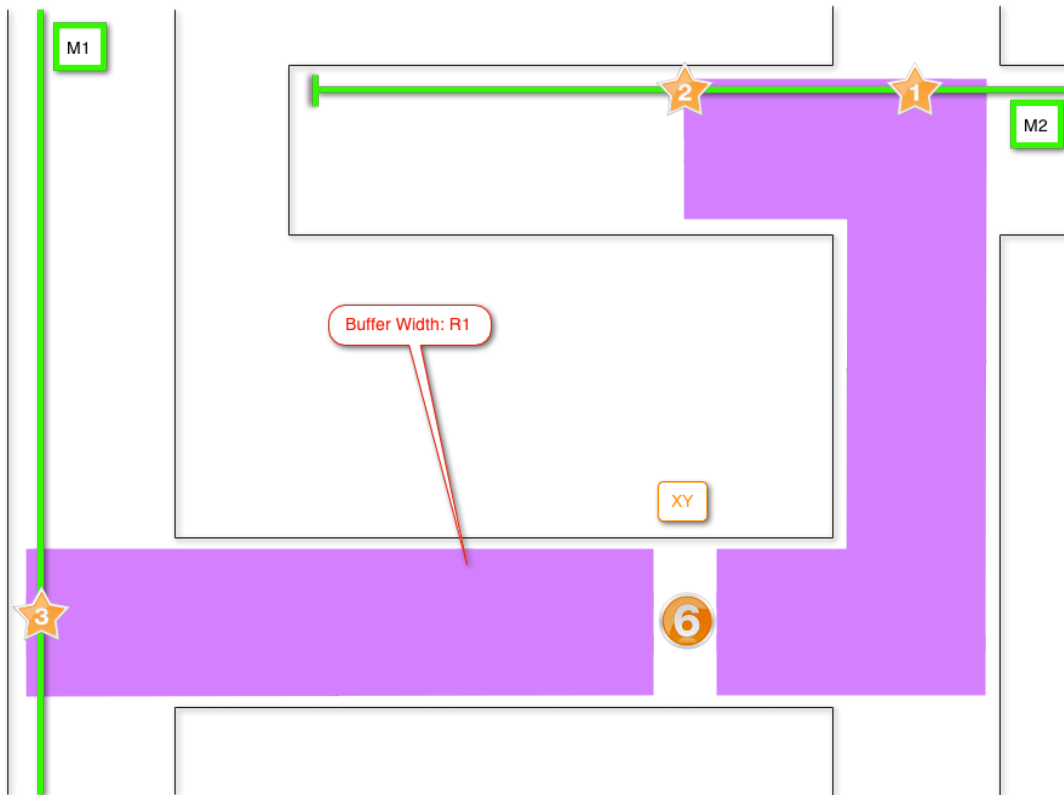
Distance to Main



1. Geocode the given address to get its latitude and longitude (**XY**). Return geocoding match confidence levels with each retrieval together with the match method (center of parcel, correct side of road etc.).
2. Find the distance to the tangent point on the closest gas main (as the crow flies) to the address (**XY**). Use a maximum search radius (**R0**) specified by National Grid as a parameter to the program. If no mains found within **R0** feet from **XY**, stop.
3. Calculate walking directions from the address **XY** to the tangent point found in (2).
4. Using the distance of the walking directions (3) as a radius, find all other gas mains within that radius from the address **XY** (mains M1, M2 in the diagram above).

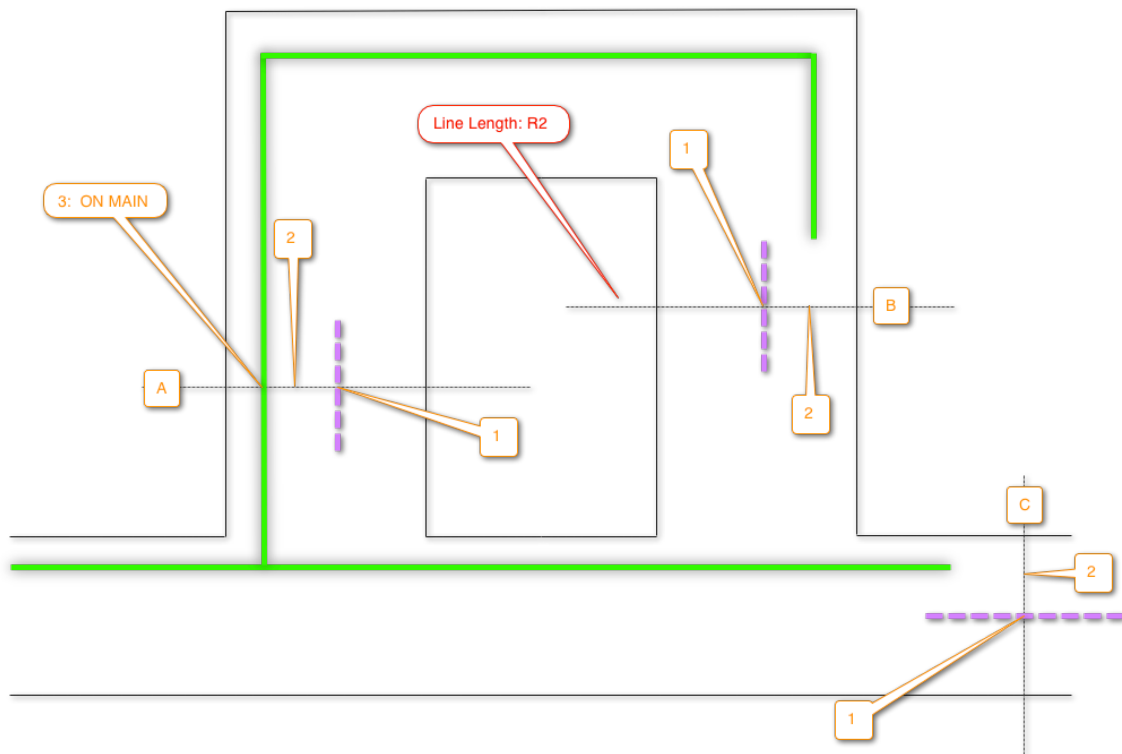


5. Calculate the walking directions from the address **XY** to the the tangent points of all mains found in (4). Note that walking directions use center lines of roads for their calculations and return paths. Store each set of walking directions as multi-point edit lines (both dashed lines in the diagram above).



1. For each multi-point edit line from (5) create a buffer around the line and find all points of intersection with mains (points 1, 2 and 3 in the diagram above). The buffer width (**R1**) will be specified by National Grid as a parameter to the program. This step relies on **R1** being large enough to pick up mains (*M1*, *M2*) which may be drawn in sidewalk. Lanes and roads can tend towards 50' in width while Boulevards can extend over 200'. **R1** cannot be too large however as it may then detect mains on parallel streets.
2. Calculate walking directions from **XY** to each intersection point found in (6).
3. Return the distance of shortest path (*point 1* in the diagram above), the geometry of the path, the main ID (*M2*), address details and the **XY** geocode point.

On-Main



1. Find the tangent point on the street center line from the address geocode point. (Addresses are *A*, *B* and *C* in the diagram above).
2. Draw a line perpendicular to the street center line at the tangent point found in (1). The line will extend **R2** feet in both directions from the tangent point. **R2** will be specified by National Grid as a parameter to the program.
3. If the line (2) intersects a main, the address is returned as “**on-main**”.

Using Center-Lines to Pre-Geocode Addresses

For most areas in the US, Street Center-Line data is available. This often includes address information (street, city, state, zip) as well as in many cases address ranges. Using this data we can predetermine the approximate locations of all potential customers and use these approximate locations to exclude those addresses that lie outside of the radius **R0** from the nearest main.

This would reduce the amount of records being passed into the “**Distance to Main**” algorithm specified above.

In addition, the same approximated positions can be used to filter out many “On-Main” records. For example, if an address is given as 25 Main Street, then it is part of the Street Center-Line section for Main Street running between numbers 1 - 30. If the entire length of this segment is off-main then 25 Main Street must also be off-main. To determine this, both ends of the segment would be passed into the “On-Main” algorithm above as points **(1)**. If both ends are found to be off-main, then all addresses from 1-30 are off-main. If either end or both ends are on-main, then address service geocoding would be necessary to establish the most accurate position for the address.

This would reduce the amount of records being passed into the “**On-Main**” algorithm above.