

High Density Postal Routing with ArcGIS





About Rapidis

Software and tools for Transportation and Logistics

simulation, modelling, analytics, scheduling and route planning

Esri Business Partner since 2003

All products and solutions are based on ArcGIS



01

Traffic Analyst provides tools for transport forecasting models and transit planning

02

Rapidis Logistics Planner for ArcGIS. 3 editions for Postal Routing, Demand Responsive Transport and Service Visits and Goods Distribution

03

Logistics Planner for ArcGIS are extensions for ArcGIS Desktop and Enterprise



Case background



- 01 Distributes printed advertisements and a free newspaper
- 02 Visits 2.7 million households twice a week
- 03 More than 20.000 routes
- 04 Bulk distribution to local depots
- 05 More than 15 years of experience with Esri technology



The challenge for a new strategy

Background:

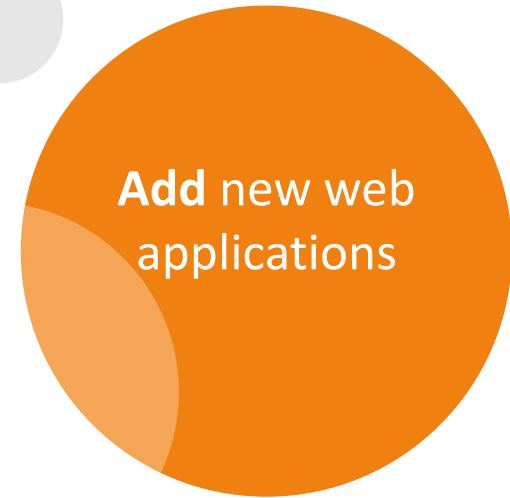
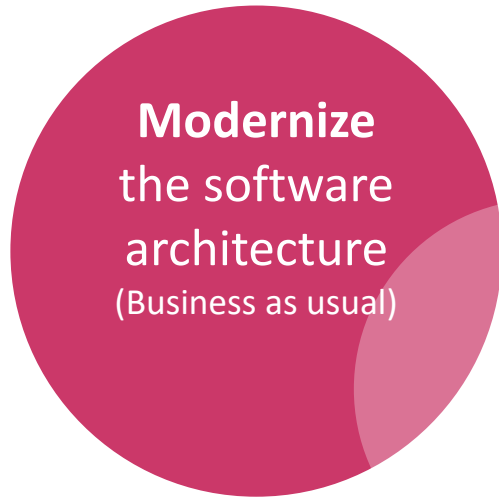
- Organic development in several directions
- Applications made with various technologies
- High risk

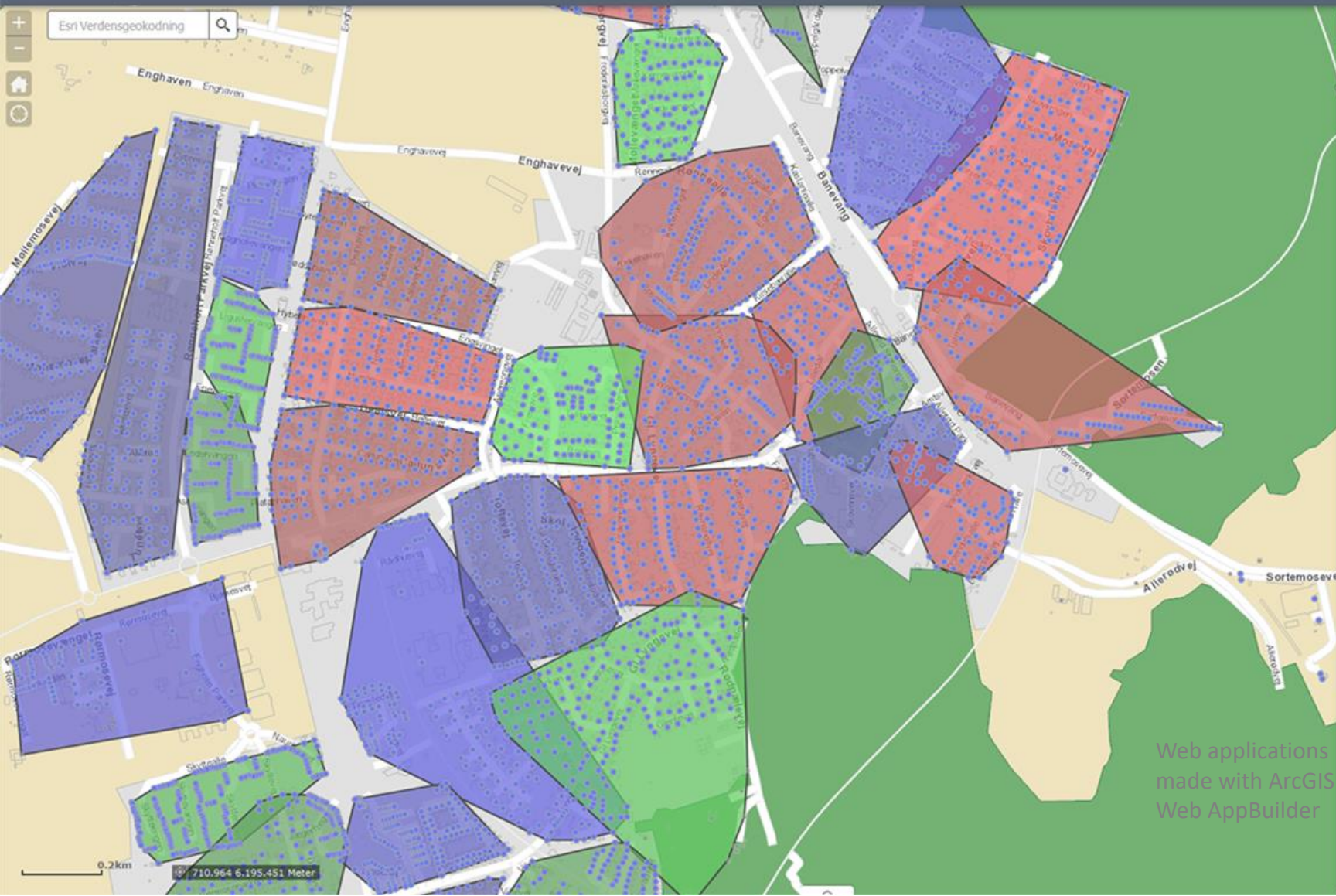
New strategy:

- Rapidis to take over development and maintenance of GIS applications
- GIS applications should be consolidated on the ArcGIS platform



The plan





Ruter

Liste af Ruter

Aktiv	Rute	Inkl	Antal	Varigh-Km	Vaegt
<input checked="" type="checkbox"/>	Ingen	1	-	-	-
<input checked="" type="checkbox"/>	1	1	148	-	-
<input checked="" type="checkbox"/>	2	1	180	-	-
<input checked="" type="checkbox"/>	3	1	38	-	-
<input checked="" type="checkbox"/>	4	1	38	-	-

Aktiver Alle Deaktiver Alle

Zoom Aktive Zoom Område

Redigering

Føj til Rute Fjern fra Rute

Beregning

Beregn Ruter Beregn Område

Ny Rute Slet Rute

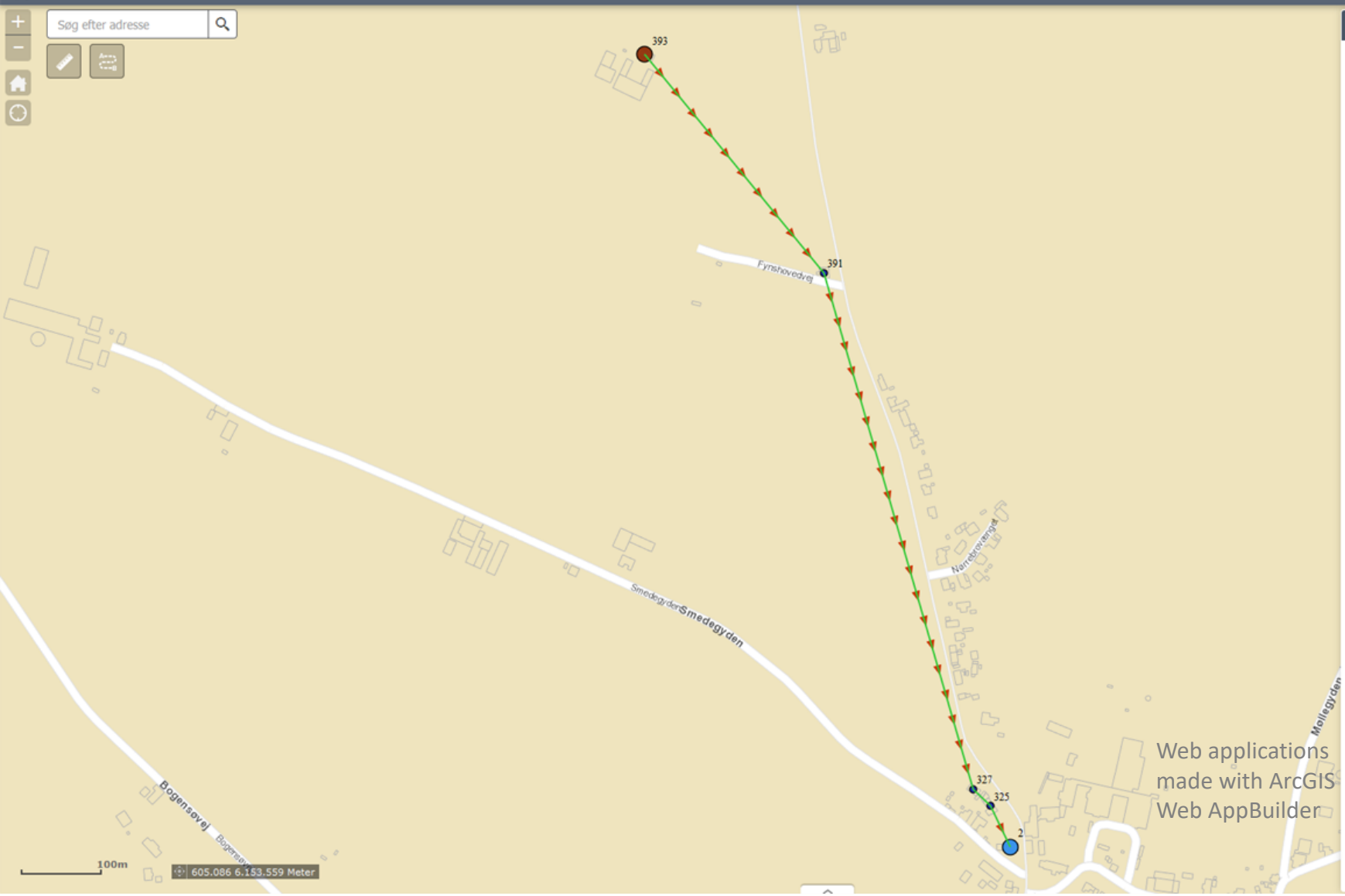
Statistik for valgte Rute

Antal adresser: -

Varighed: -

Web applications
made with ArcGIS
Web AppBuilder

Sequence optimization, each individual route is optimized for best sequence for manual editing



Rediger Rute

Rute 300 i postnr 5380

Aktiv	Adresse	Laas
<input type="checkbox"/>	Fynshovedvej 393	<input type="checkbox"/>
<input type="checkbox"/>	Fynshovedvej 391	<input type="checkbox"/>
<input type="checkbox"/>	Fynshovedvej 327	<input type="checkbox"/>
<input type="checkbox"/>	Fynshovedvej 325	<input type="checkbox"/>
<input type="checkbox"/>	Smedegyden 2	<input type="checkbox"/>

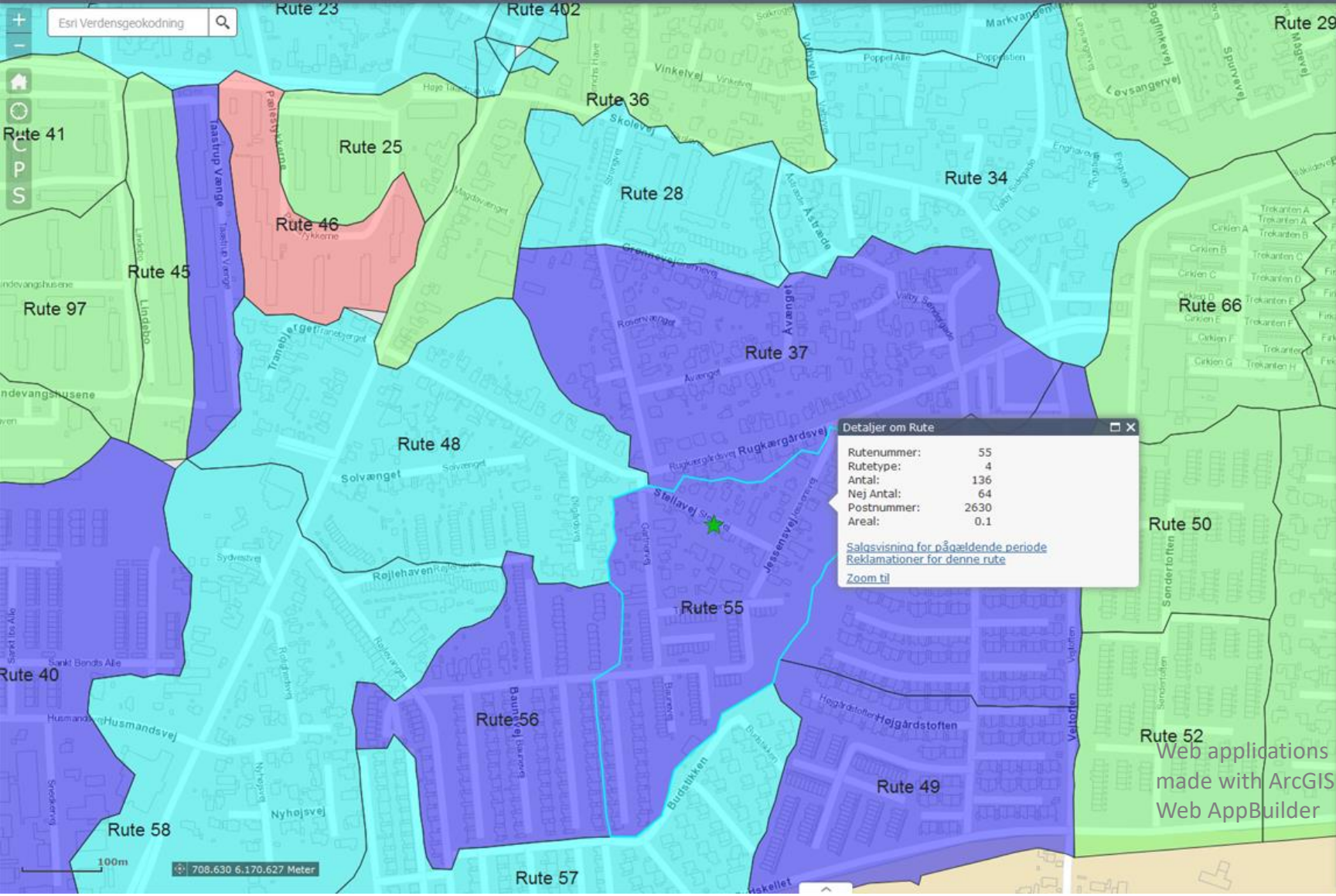
▼ Aktivering af adresser

▼ Redigering af Rækkefølge

▼ Andre Opgaver

Flyt Huspunkter Flyt Vejpunkter

Web applications
made with ArcGIS
Web AppBuilder



Omraade

Område:

Løbenummer (rute):

Periode:

Version 1.4

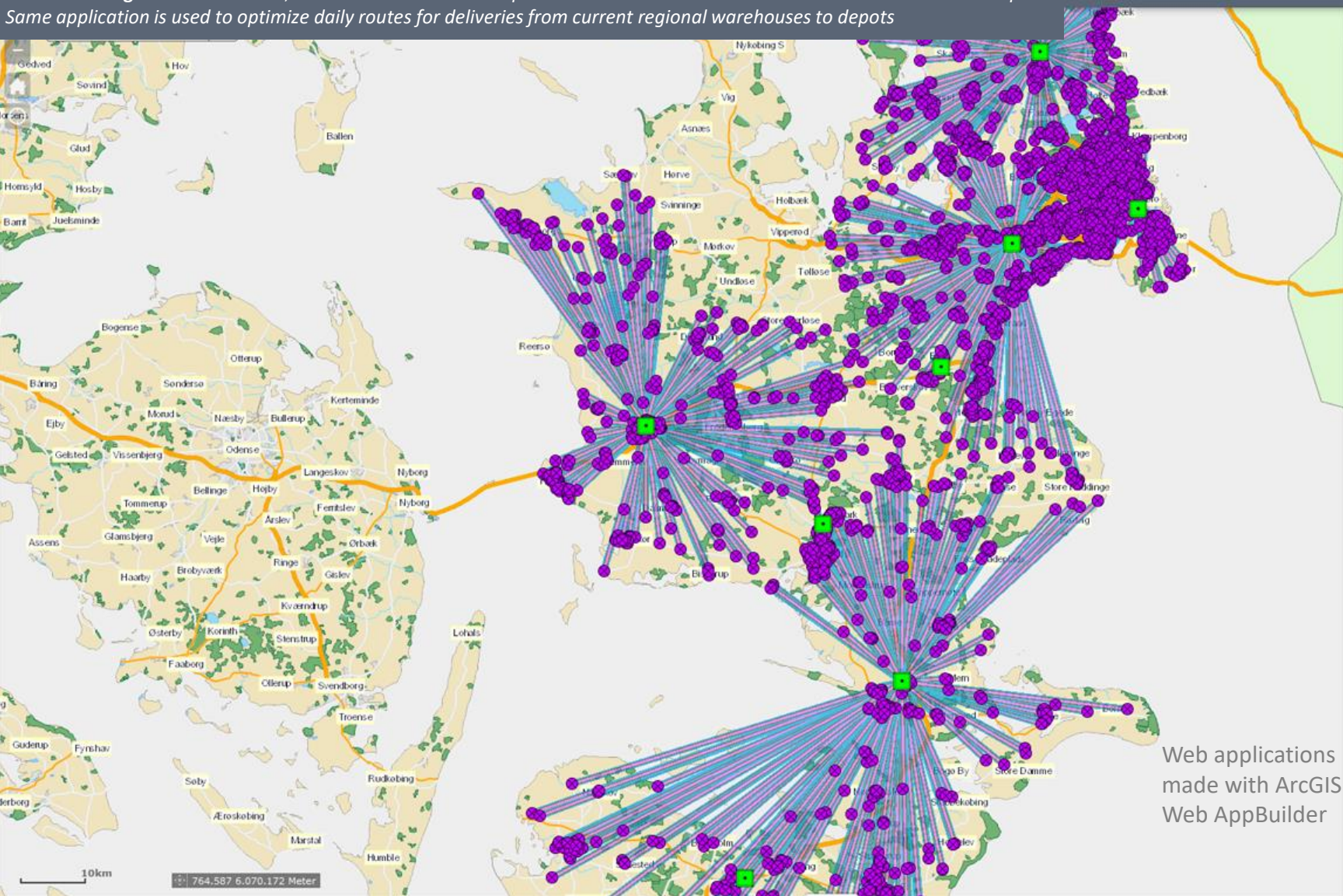
Detaljer om Rute

Rutenummer:	55
Rutetype:	4
Antal:	136
Nej Antal:	64
Postnummer:	2630
Areal:	0.1

[Salgsvisning for pågældende periode](#)
[Reklamationer for denne rute](#)
[Zoom til](#)

Web applications
made with ArcGIS
Web AppBuilder

Location of regional warehouses, calculates and visualizes optimal warehouse locations based on actual deliveries to depots. Same application is used to optimize daily routes for deliveries from current regional warehouses to depots



Mulige Lager Placeringer

Lokationer

ID	Titel
38003	Gammel Frederiksborgvej
38007	Vindsløsevej
38008	Mågevej
38009	Fåbøvej

Nyt Forslag **Mange Forslag**

Slet Område **Slet Alle**

Resultat

ID	Titel	Antal	Km	Vaegt
38003	38003F1	462	8800.3	5680275
38004	38004F2	704	5989.4	7363532
38005	38005F3	639	10981.5	1452249
38006	38006F4	473	15721.7	4048016

Analyse

Antal lagre der skal vælges:

Start Analyse **Vis Log**

Slet Resultat

Brug Resultat **Brug Lagre**

Web applications made with ArcGIS Web AppBuilder



Benefits

- Consolidation on a single software platform
- Easily supportable applications
- Market leading software from dependable partner
- Modern services based architecture
- Platform allows for easy implementation of new productivity applications
 - Equal size/work time for all routes
 - Routes are efficient and safe
 - Reduced overall number of routes
 - Reduced planning time
 - Quick reaction to changing conditions



Tools used

- ArcMap
- ArcGIS Server
- Web AppBuilder
- Portal for ArcGIS
- ArcGIS Network Analyst
- ArcGIS JavaScript API
- Rapidis Logistics Planner for ArcGIS Postal edition
- Rapidis Logistics Planner for ArcGIS VRP edition



Routing: Postal – Dense – High Density

When

- Cover all/most addresses in an area
- Postal delivery
- Newspaper delivery



Objectives

- Efficient routes: Time, KM, CO2
- Minimize number of routes
- Routes with no overlap
- Safe routes



What to expect

- Less work time per route
- Fewer routes
- Routes with equal work time
- Adapt to changes; even daily
- Evaluate several scenarios





Different from other logistic problems

Size of the problem

- More locations than VRP
- Capacity depends on configuration



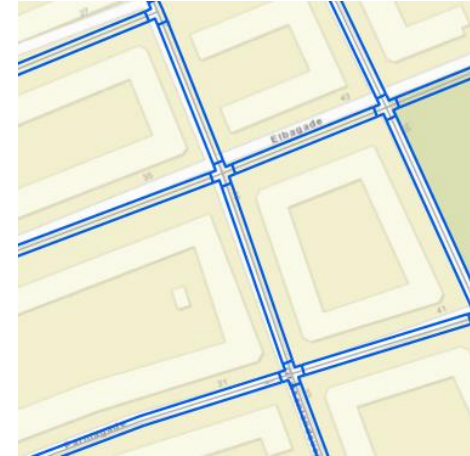
Travel speed

- Walking
- Biking or Scooter
- Car



The Networks

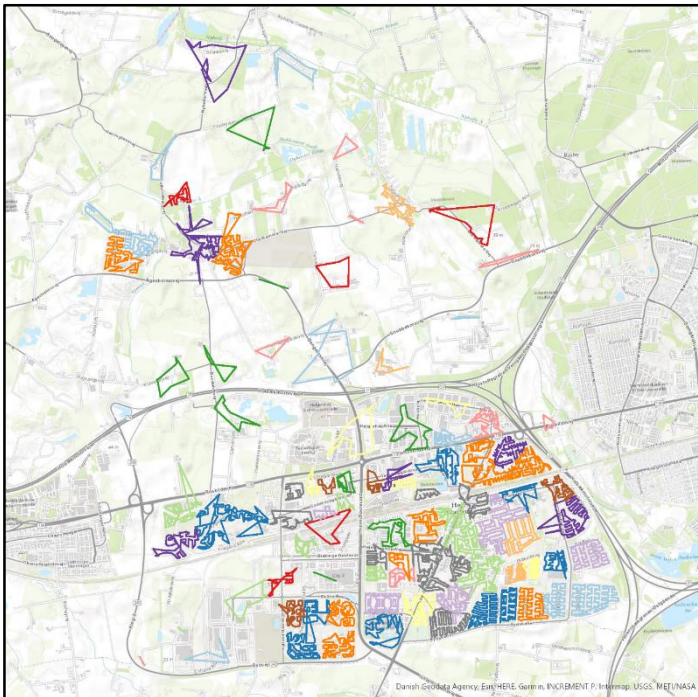
- A sidewalk network is created for walking/biking
- This is an automated process
- Standard network for routes by car





Modes

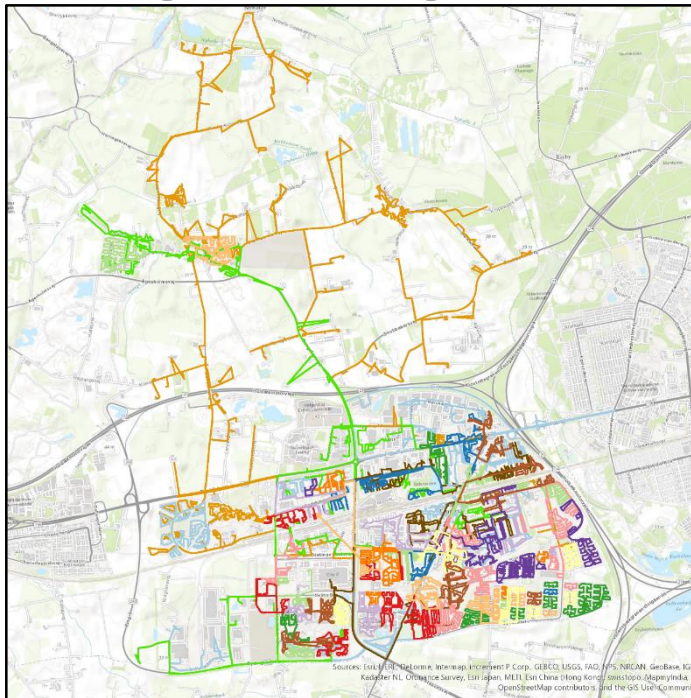
Walking, no Driving



Postal solution was primarily designed for planning routes serviced by walking, bicycles and scooters.

These routes are planned in a sidewalk network. Allows fine-grained control over street crossings.

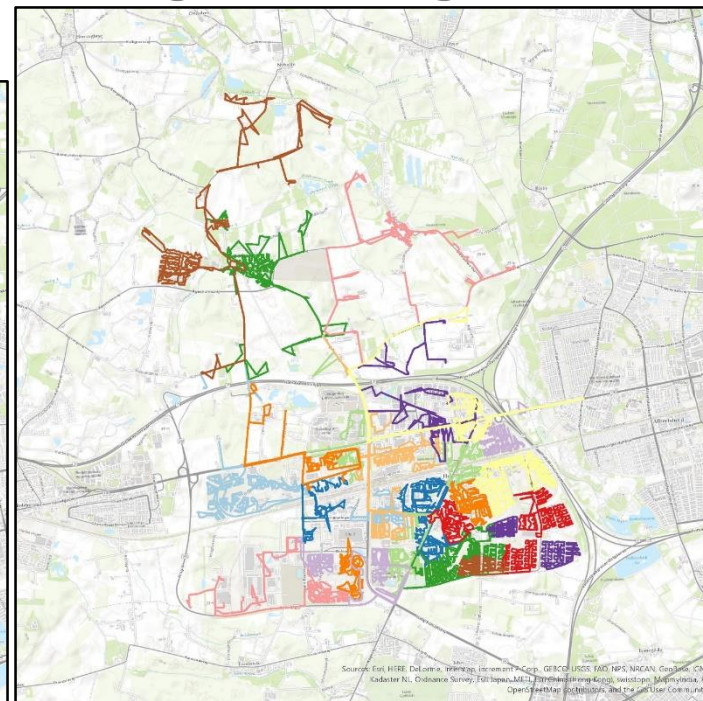
Walking and Driving



New: Support for road vehicles.

The optimization can now choose for each route if it should use a sidewalk based mode or a road mode.

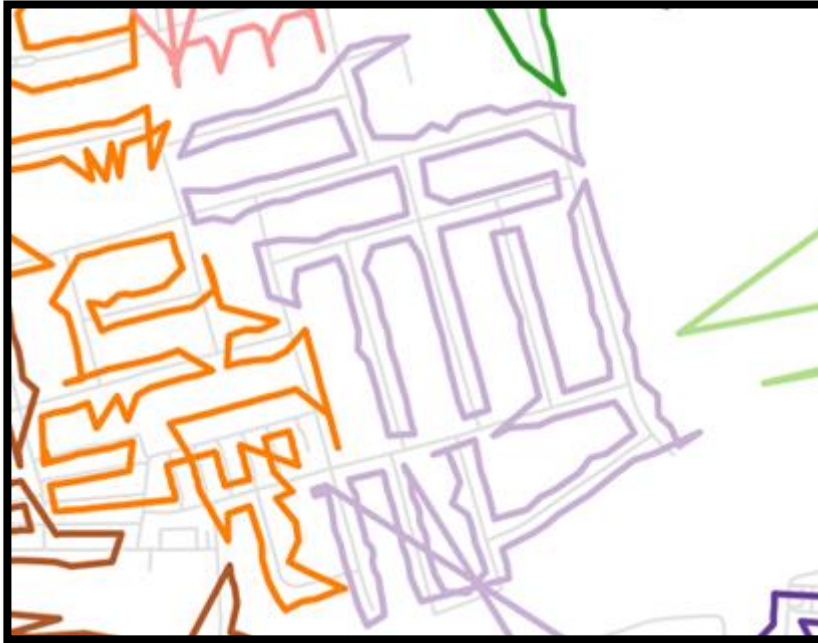
Driving, no walking



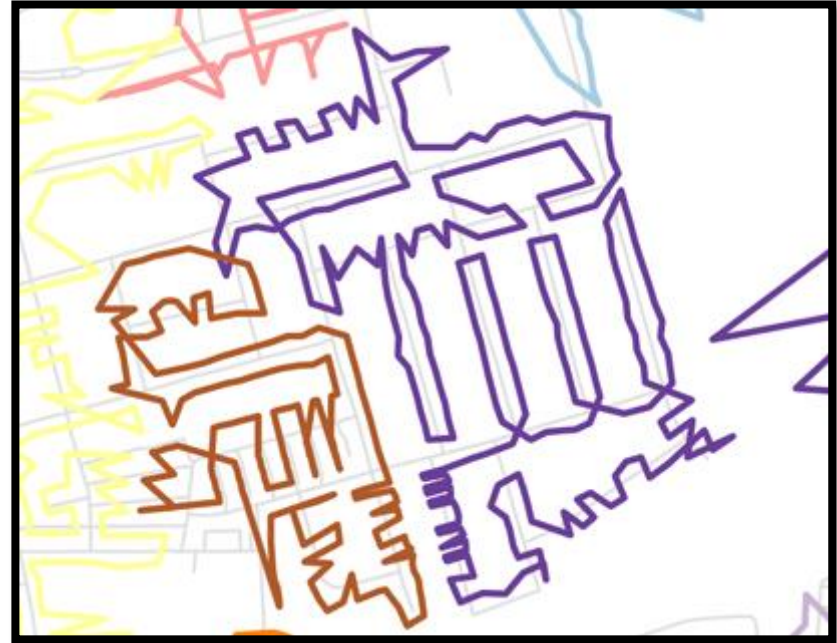


Same input – Different parameter settings

Penalties for crossing is set to higher levels



Crossing penalties for minor roads are reduced to encourage "zig-zag" routes where minor streets are only traversed once, serving addresses on both sides of the street.



There are two types of crossing penalties, which in this case have both been reduced: A penalty for crossing streets at intersections and a penalty for crossing streets outside intersections.



Materials available

Product Flyer

Logistics Planner Postal **Rapidis**
Postal Routes **Dense Routing**
High Density Routing

Logistics Planner Postal offers High Density Routing tools for Postal Routes and Newspaper Distribution.

Serve a large area with efficient postal routes

- Minimize number of routes and use all available work time
- Plan efficient routes with no overlaps and minimized transport distance
- Safe routes – crossing of roads can incur a penalty
- Use various parameters to control constraints, priorities and depots
- Supports delivery by car and walking or bicycling mail carriers

Workflow for planning postal routes:

- As an **extension for ArcGIS**
- Server and Desktop**
- Includes **server Geoprocessing tools**
- As a **hosted Geoprocessing REST service**
- Configurable web applications out of the product**
- Contact Rapidis for a free online demo, trial, prices, etc. consultation and more.**

Workflow supported by Geoprocessing Tools:

- As an **extension for ArcGIS**
- As a **hosted Geoprocessing REST service**
- Configurable web applications out of the product**
- Contact Rapidis for a free online demo, trial, prices, etc. consultation and more.**

For ArcGIS or as a hosted service:

- Postal Edition for ArcGIS is supported by ArcMap, ArcGIS Pro and ArcGIS Server
- Cloud hosted web service to integrate with existing systems

The Postal edition of Logistics Planner is available as a cloud hosted web service and as an extension for ArcGIS server and desktop.

Build on **Network Analyst** and provides route optimization as **Geoprocessing tools** for seamless integration with the **existing ArcGIS Platforms**

Rapidis Logistics Planner is for daily planning and for long term strategic planning

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Tutorial 34 pages

Rapidis

Title: Tutorial_Postal_Edition
 Project: Logistics Planner for ArcGIS

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ArcMap Demo

Geoprocessing - Assign Locations to Sidewalk and Road

Parameters | Environments

- Locations
- Sidewalks
- Roads
- Road-Sidewalk relations
- Configuration

Output: Locations, with sidewalk and road connections
 Output: Lines connecting locations with sidewalks
 Output: Lines connecting locations with roads

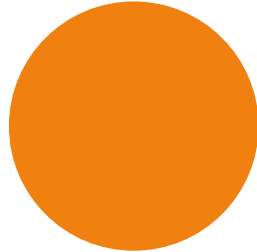
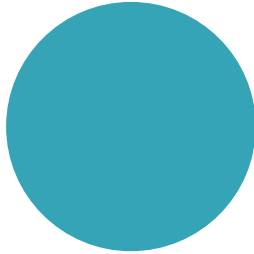
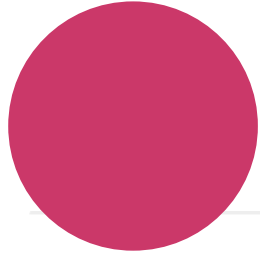
Run (R)

1:1,290 | 012,27E 55,64N

Trial extension



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Appendix, Technology

- Route optimization tools are Geoprocessing tools
- 9 tools in total
 - 7 pure Python tools
 - 2 tools use a combination of Python, C++ and C#
- Customer optimization workflows implemented using these tools, ArcGIS tools and – if necessary – custom Python scripts.
 - Usually tied together with ArcGIS Model Builder
 - Very high flexibility
 - Very easy customization
- Finished workflow is published to ArcGIS Server as a REST Geoprocessing service
 - Service API is an Esri technology – not Rapidis
 - Built-in scale-out infrastructure
 - Many service clients (on next slide)
- Service output can also be accessed from database clients.
 - Optimization tools will usually write results to a database
 - Open data model. Easy integration.



Appendix

ArcGIS Geoprocessing REST Service clients

- ArcGIS JavaScript API
 - Use in websites
 - Build WebApps with WebAppBuilder
 - Integrate in Portal for ArcGIS
 - Such apps shown in demo in a minute
- ArcGIS Runtime SDK
 - Build custom desktop applications
 - Build mobile apps
- ArcGIS REST API
 - Use from any client that knows REST
- (new) ArcGIS Python API and (old) Arcpy Python API
- Many standard ArcGIS Apps:
 - Workforce, Navigator, Dashboard, Collector, etc.



Appendix, inside the optimization tools

- All tools use Arcpy for data access
- All ArcGIS Supported storage and databases are supported
- Tools perform validation of data schema – if requested
- Transport networks stored in ArcGIS Network Datasets
 - Few requirements, will work with most (if not all) commercial networks
- Cost matrices built with ArcGIS Network Analyst. Gives us access to:
 - Very robust network platform
 - No practical limits on network database size
 - Sophisticated modelling:
 - Curb approach
 - Prevent or penalize left turns
 - Many forms of restrictions (turns, one-way, soft/hard, large vehicles, etc.)
 - U-turns
 - Time-of-day / congestion / traffic – if necessary
- Postal-specific optimizations (VRP and TSP) built on top of cost matrices
 - Scale-up: Postal VRP tool has a parallel architecture, which makes efficient use of server CPUs and CPU cores