GENESIS

GENeric European Sustainable Information Space for Environment

Proposal 223996 - DG-INFSO Call FP7-ICT-2007-2

GENESIS Consortium

CERC/ICSTM/UWS WP2300

- Major EU 7th Framework ICT project to develop open software tools for environment and health (2008-2011)
- London pilot: CERC, Imperial College, UWS.
- Air quality → exposure + dose response → health impact

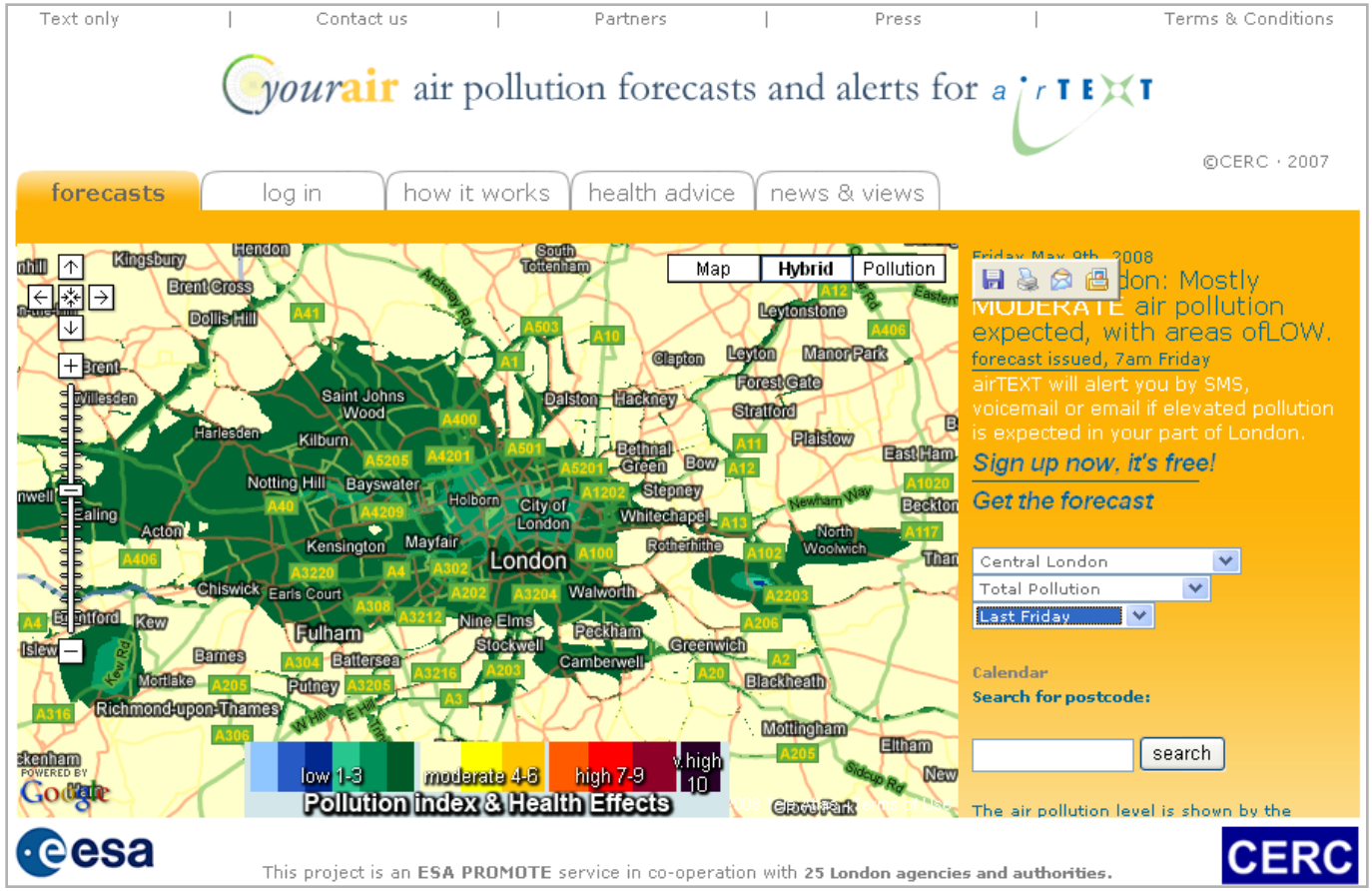
WHAT IS GENESIS ABOUT?

- GENESIS is an EU 7th Framework Programme project.
- It has run for 3 years from September 2008
- It is headed up by French company Thales
- The title is: **ICT for Environmental Management and Energy Efficiency Collaborative Systems for Environmental Management**
- It is a large-scale integrating project
- The aim is to produce **open, generic, useful tools** for environmental and health applications. The open tools will use a computing power at Thales.
- To define and test out the tools there are "**Thematic**" projects on water and air quality.
- There is a London-based air quality Thematic project.

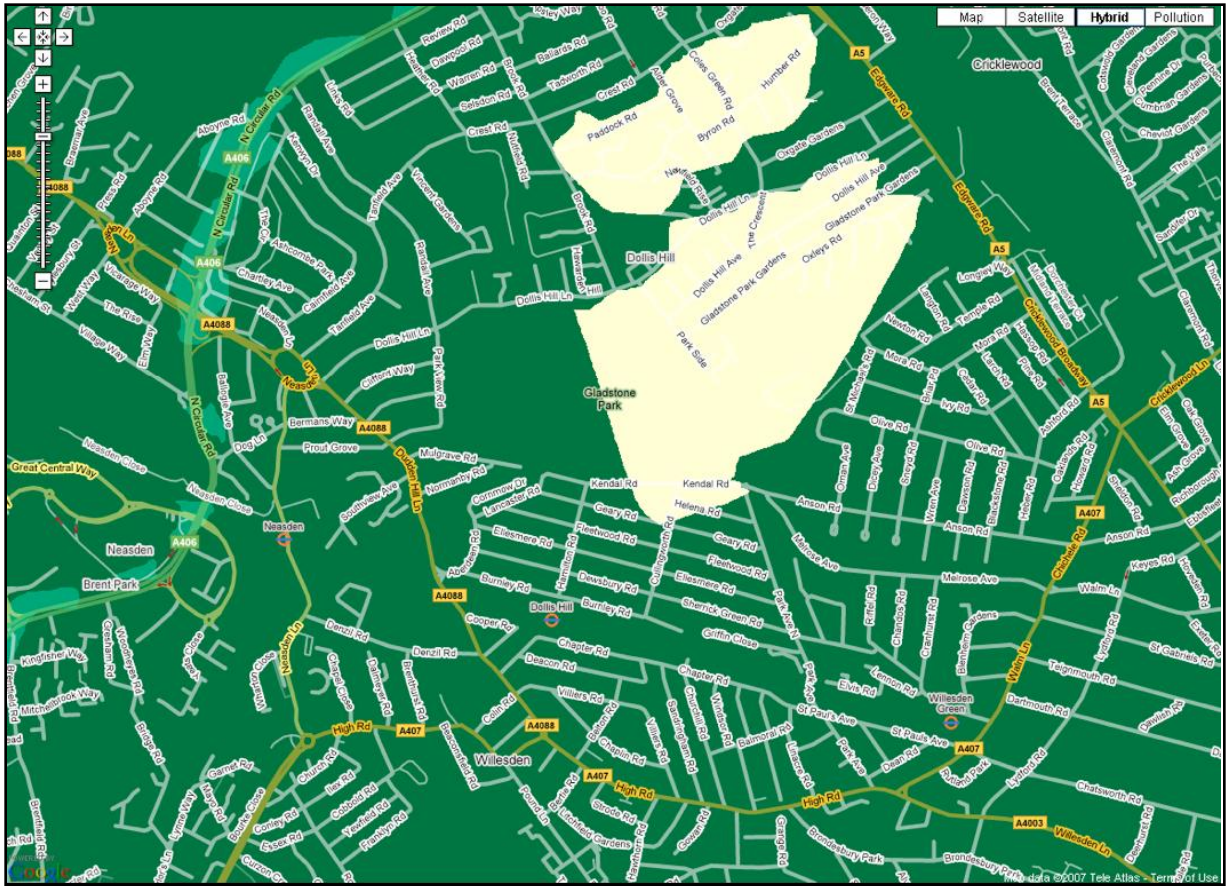
THE LONDON THEMATIC PROJECT

- Partners
  - Cambridge Environmental Research Consultants
  - Imperial College of Science Technology and Medicine (John Gulliver, Gioia Mosler)
  - University of the West of Scotland – Yang Wang
- What exists already?
  - Spatially detailed plots of concentration, typically maximum hourly concentration for 1 day or daily average. Time information understood by system.
  - STEMS, Space-Time Exposure Modelling System
    - a modelling system,theoretical and GIS-based - non-GUI, partly developed scripts
    - Not in any user domain and accessible to one or two researchers
- What will be developed & by whom
  - CERC
    - More detailed time resolution of input to concentration modelling **e.g. near real time traffic data** and increased concentration output e.g. serious of hourly plots
  - UWS
    - Develop STEMS into a fully-fledged exposure assessment software for the public – GENESIS OUTPUT

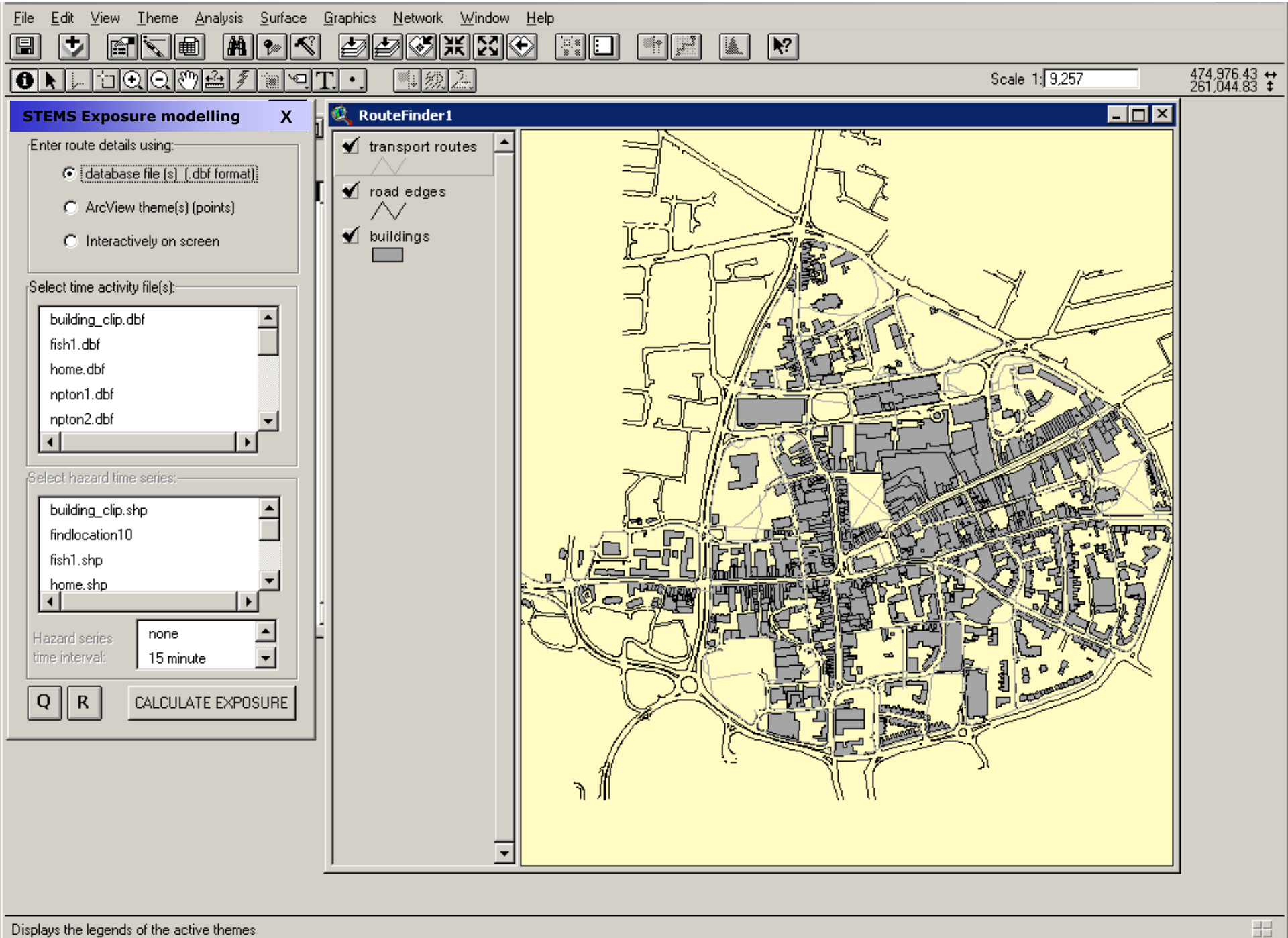
What exists already? Spatially detailed concentration data



What exists already? Spatially detailed concentration data



What exists already? STEMS, Space-Time Exposure Modelling System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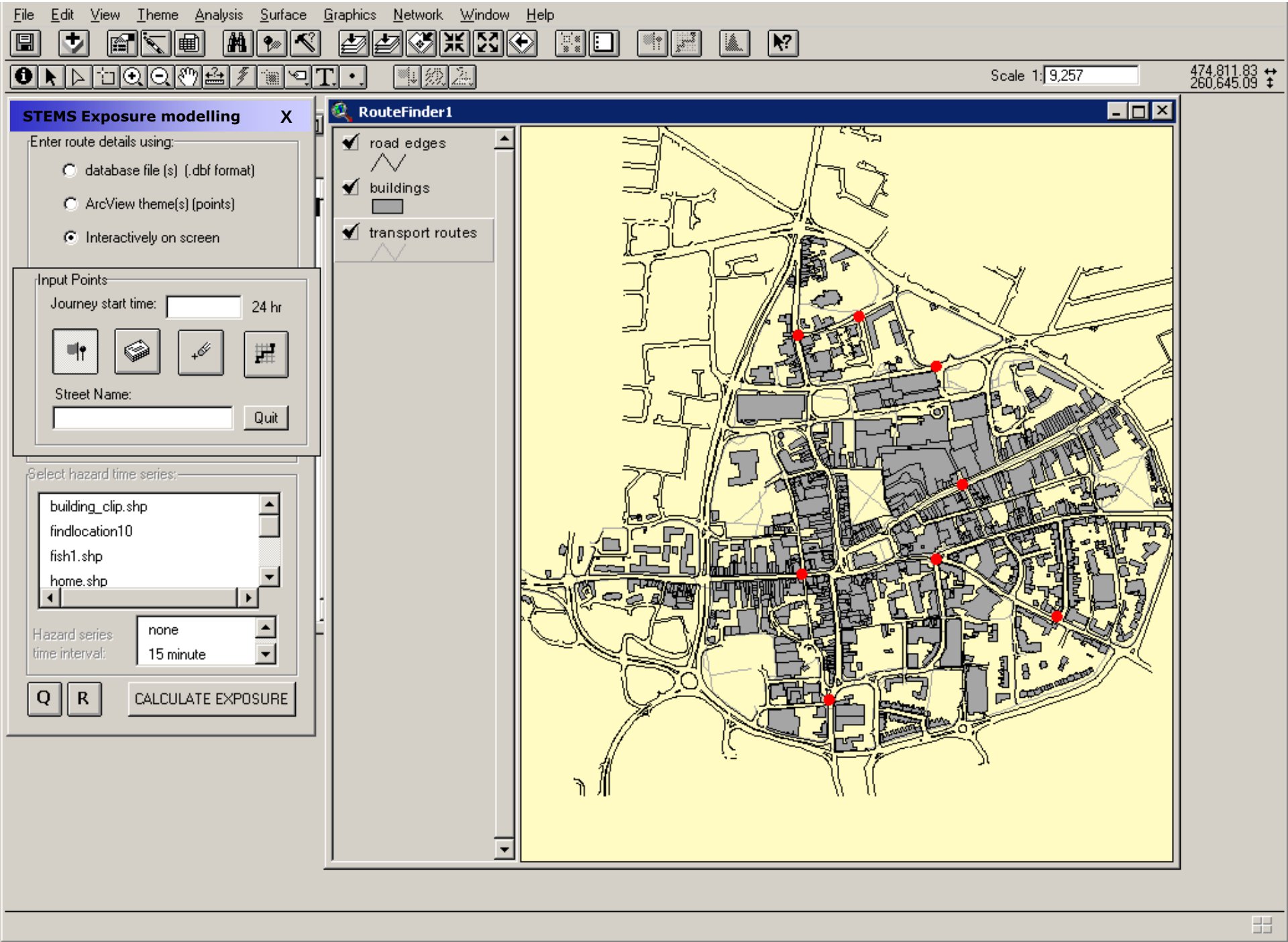
261,044.83
STEMS Exposure modelling
X
Enter route details using:
database file (s) (.dbf format)
ArcView theme(s) (points)
Interactively on screen
Select time activity file(s):
building_clip.dbf
fish1.dbf
home.dbf
npton1.dbf
npton2.dbf
Select hazard time series:
building_clip.shp
findlocation10
fish1.shp
home.shp
Hazard series time interval:
none
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
transport routes
road edges
buildings
Displays the legends of the active themes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STEMS Exposure modelling
X
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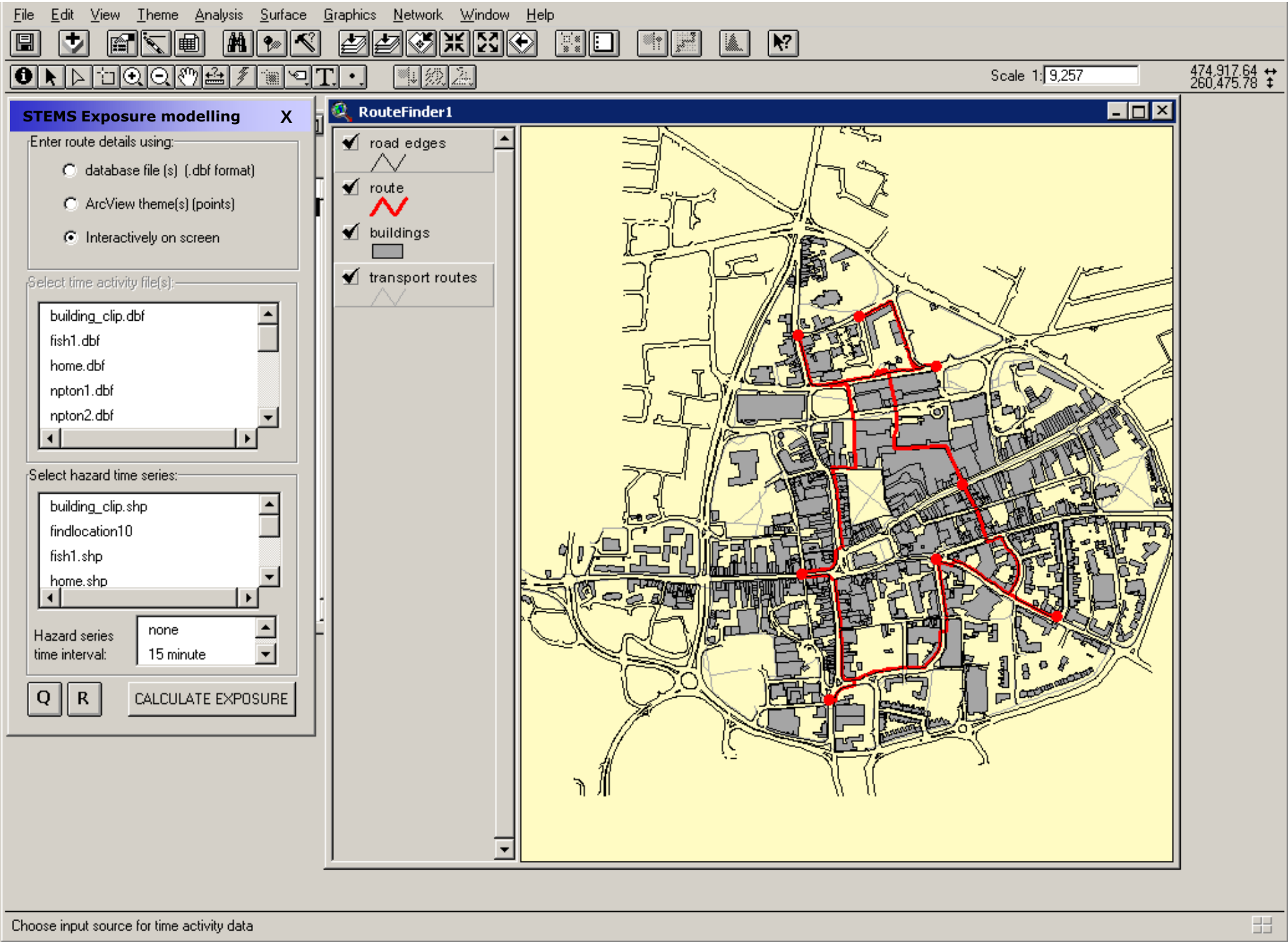
database file (s) (.dbf format)
ArcView theme(s) (points)
Interactively on screen
Input Points
Journey start time:
24 hr
Street Name:
Quit
Select hazard time series:
building_clip.shp
findlocation10
fish1.shp
home.shp
Hazard series
none
time interval:
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
road edges
buildings
transport routes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Enter route details using:
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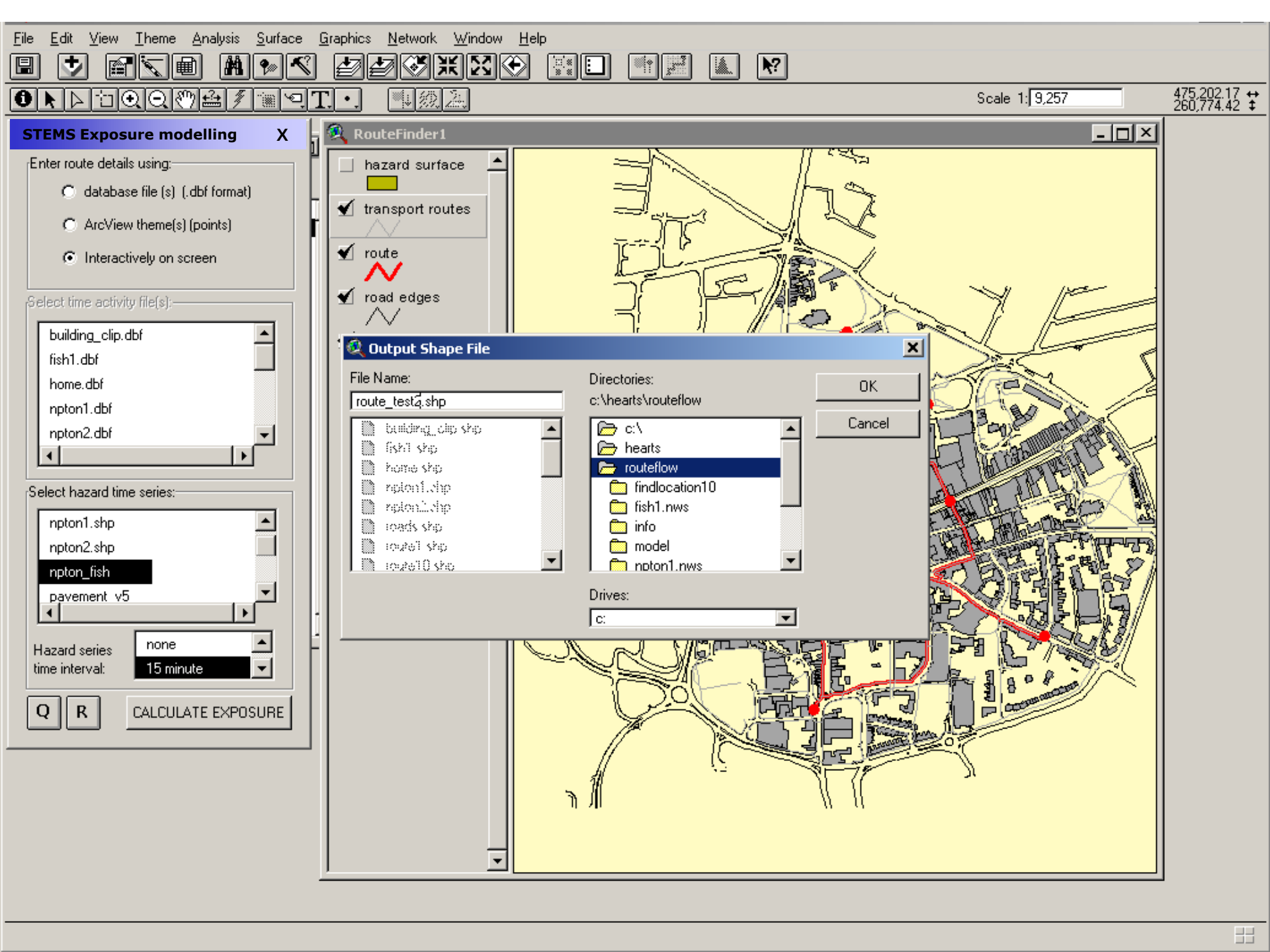
ArcView theme(s) (points)
Interactively on screen
Select time activity file(s):
building_clip.dbf
fish1.dbf
home.dbf
npton1.dbf
npton2.dbf
Select hazard time series:
building_clip.shp
findlocation10
fish1.shp
home.shp
Hazard series time interval:
none
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
road edges
route
buildings
transport routes
Choose input source for time activity data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ArcView theme(s) (points)
Interactively on screen
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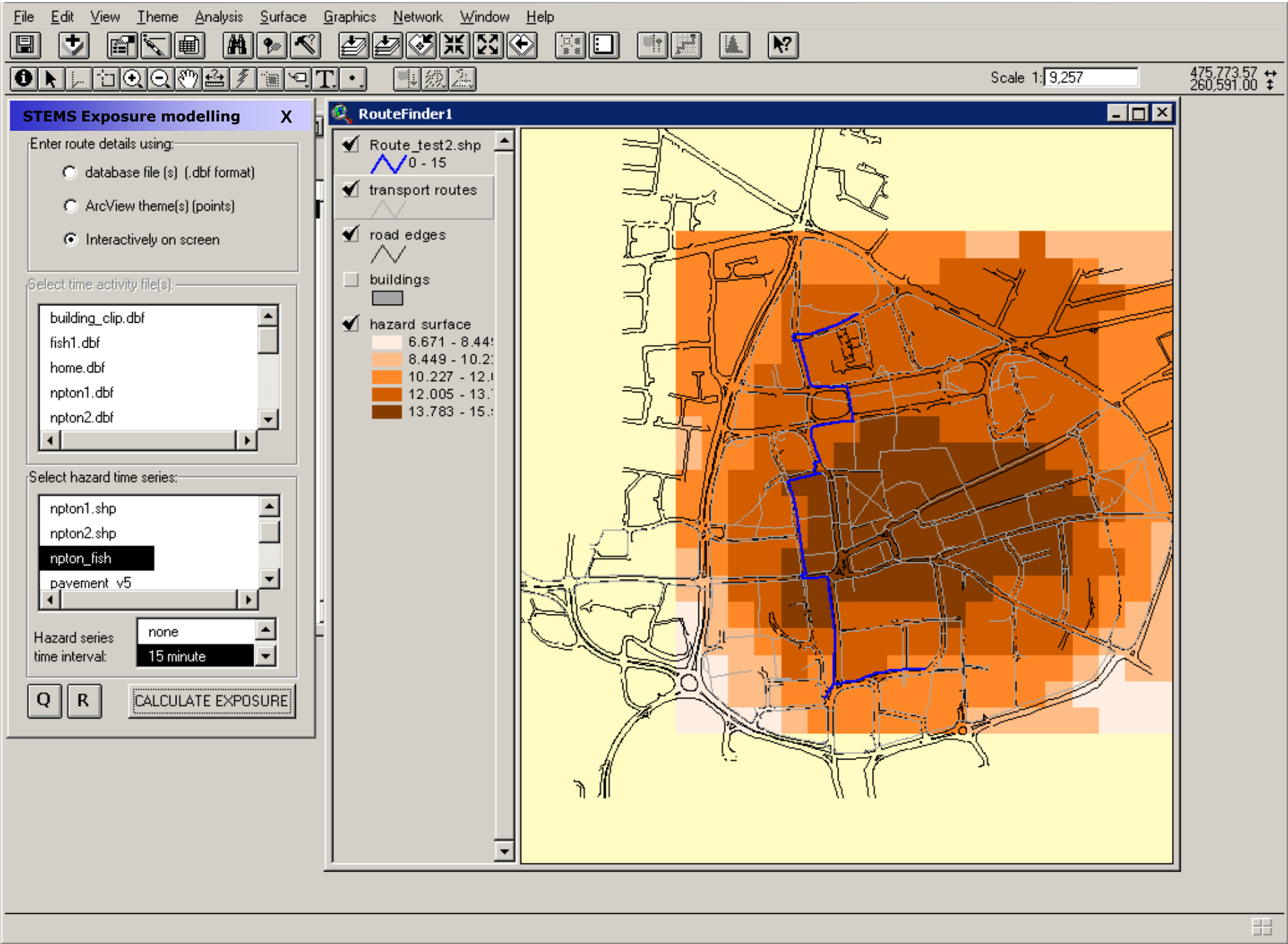
building_clip.dbf
fish1.dbf
home.dbf
npton1.dbf
npton2.dbf
Select hazard time series:
npton1.shp
npton2.shp
npton_fish
pavement_v5
Hazard series time interval:
none
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
hazard surface
transport routes
route
road edges
Output Shape File
File Name:
route_test4.shp
Directories:
c:\hearts\routeflow
OK
Cancel
c:\
hearts
routeflow
findlocation10
fish1.nws
info
model
npton1.nws
Drives:
c: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ArcView theme(s) (points)
Interactively on screen
Select time activity file(s):
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fish1.dbf
home.dbf
npton1.dbf
npton2.dbf
Select hazard time series:
npton1.shp
npton2.shp
npton_fish
pavement_v5
Hazard series time interval:
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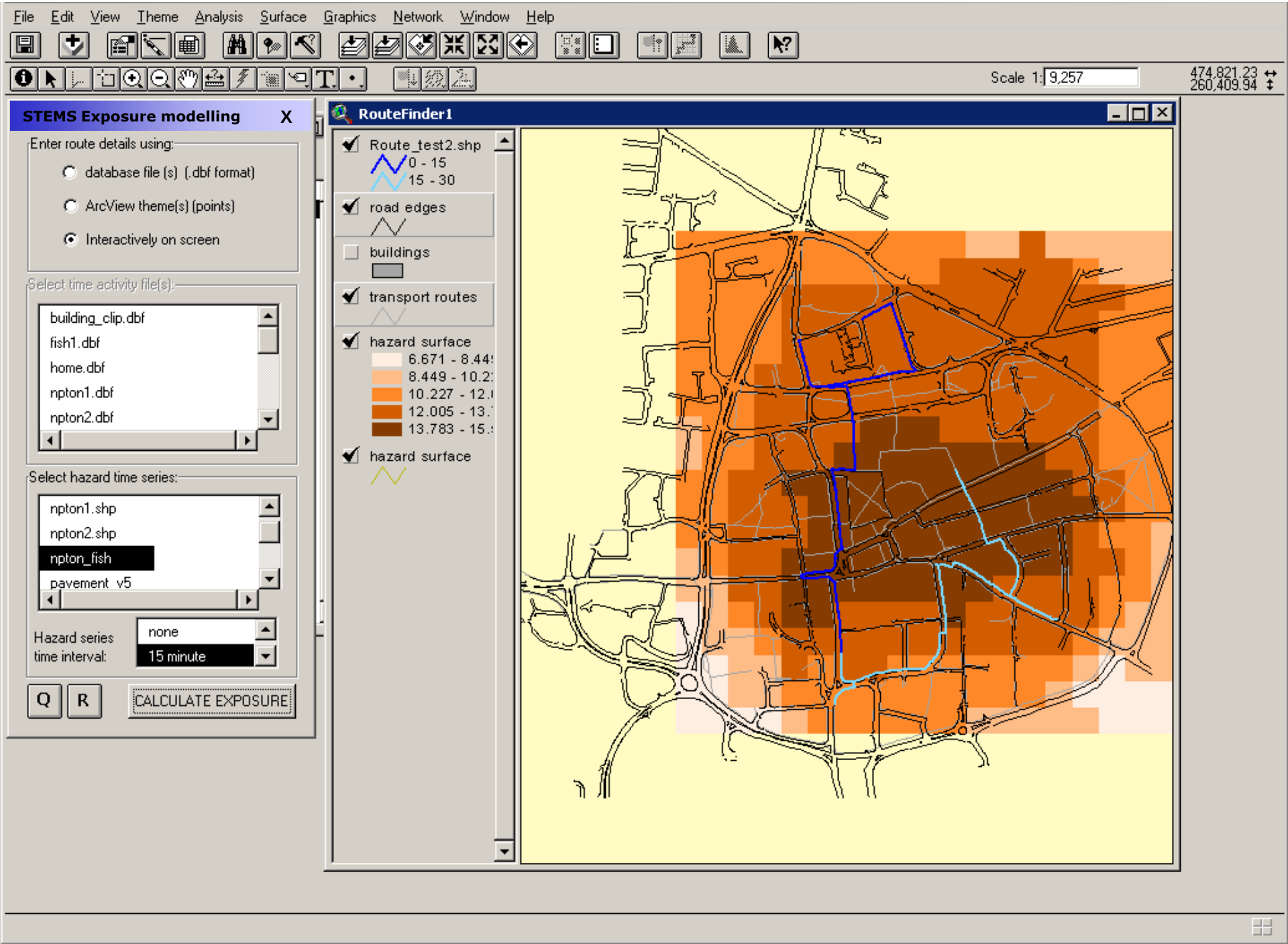
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
Route_test2.shp
0 - 15
transport routes
road edges
buildings
hazard surface
6.671 - 8.44
8.449 - 10.2
10.227 - 12.
12.005 - 13.
13.783 - 15.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STEMS Exposure modelling
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Enter route details using:
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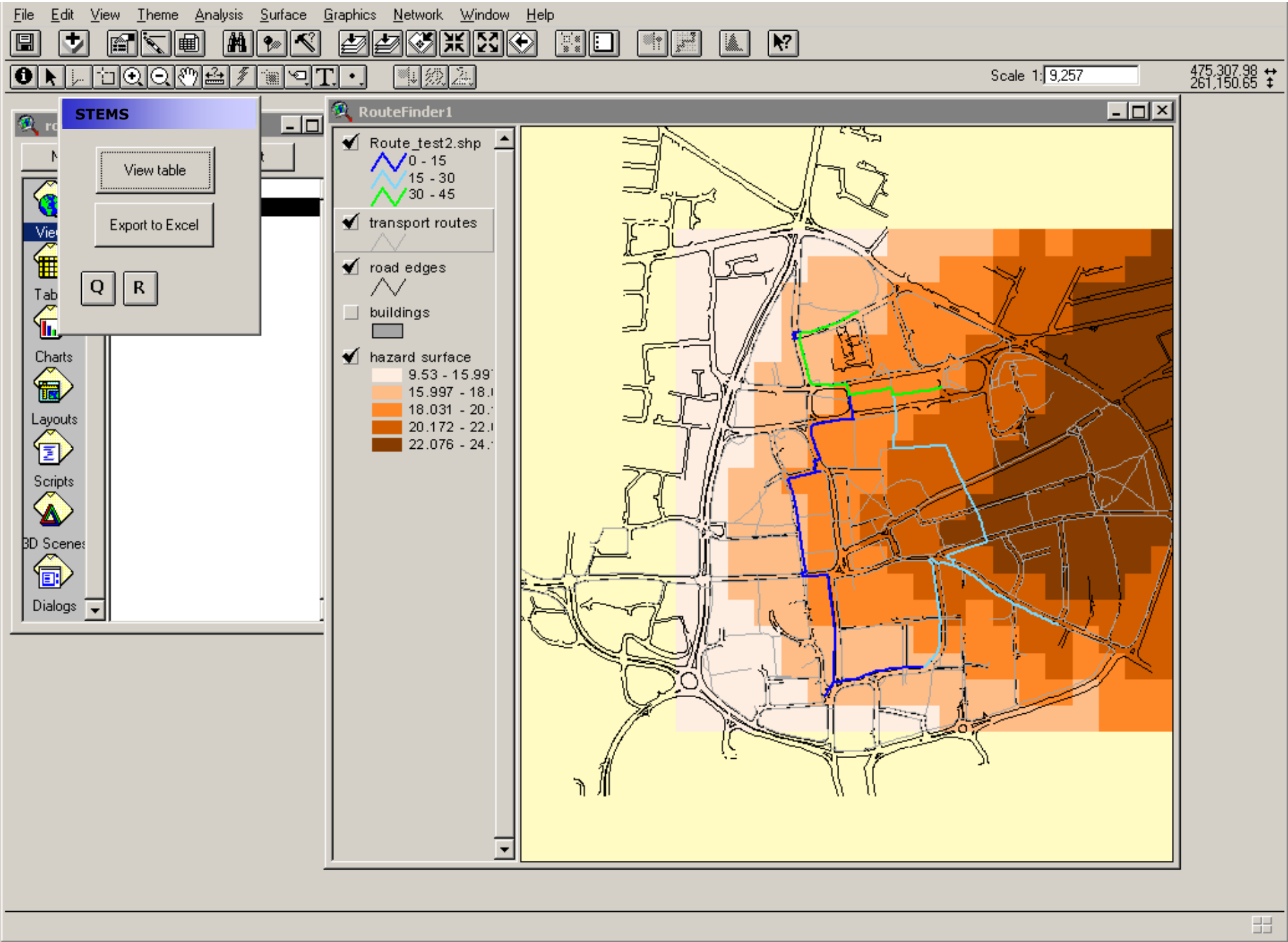
ArcView theme(s) (points)
Interactively on screen
Select time activity file(s):
building_clip.dbf
fish1.dbf
home.dbf
npton1.dbf
npton2.dbf
Select hazard time series:
npton1.shp
npton2.shp
npton_fish
pavement_v5
Hazard series time interval:
none
15 minute
Q
R
CALCULATE EXPOSURE
RouteFinder1
Route_test2.shp
0 - 15
15 - 30
road edges
buildings
transport routes
hazard surface
6.671 - 8.44
8.449 - 10.2
10.227 - 12.
12.005 - 13.
13.783 - 15.
hazard surface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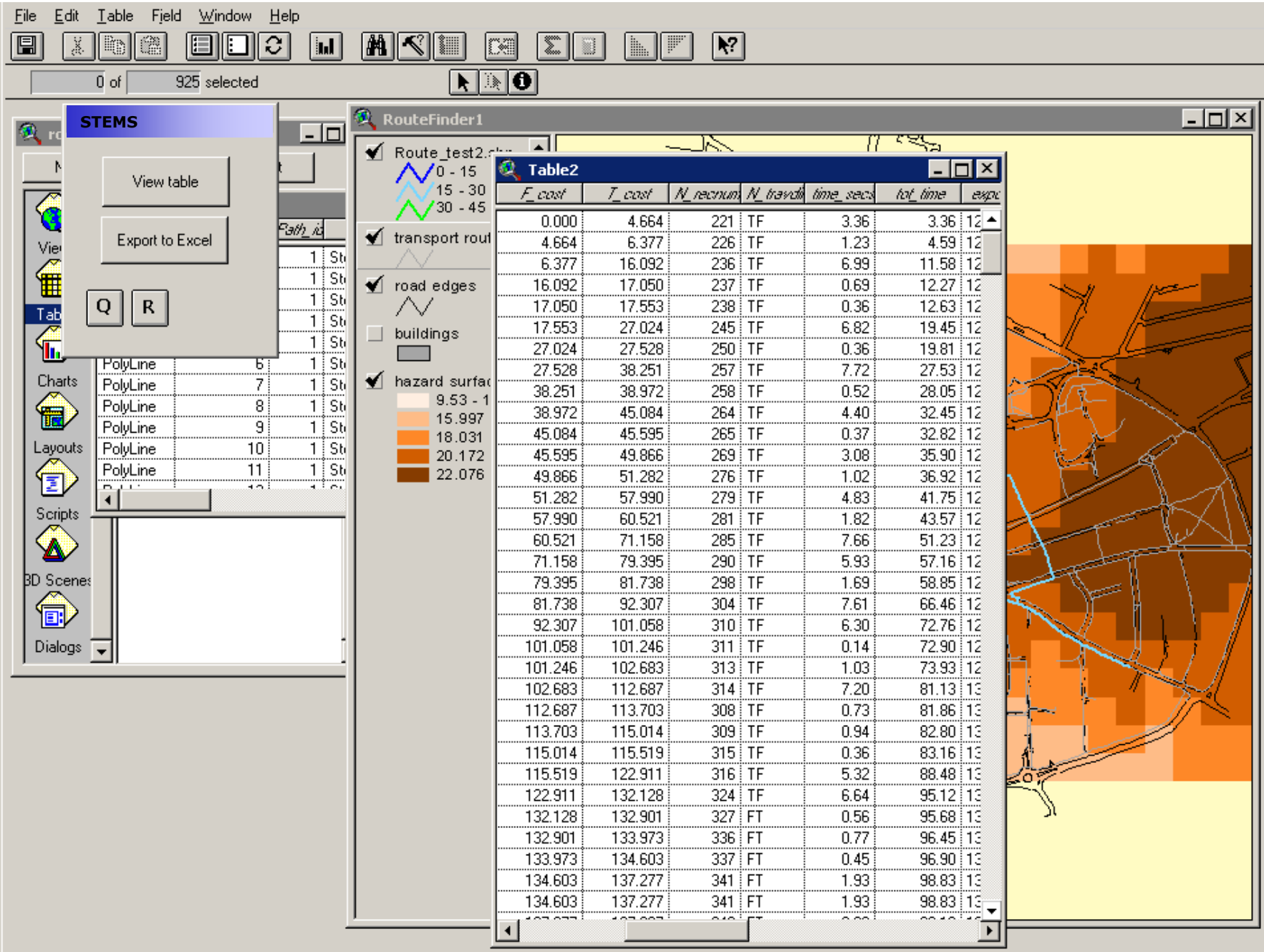
STEMS
View table
Export to Excel
Q
R
Charts
Layouts
Scripts
3D Scenes
Dialogs
RouteFinder1
Route_test2.shp
0 - 15
15 - 30
30 - 45
transport routes
road edges
buildings
hazard surface
9.53 - 15.99
15.997 - 18.
18.031 - 20.
20.172 - 22.
22.076 - 24.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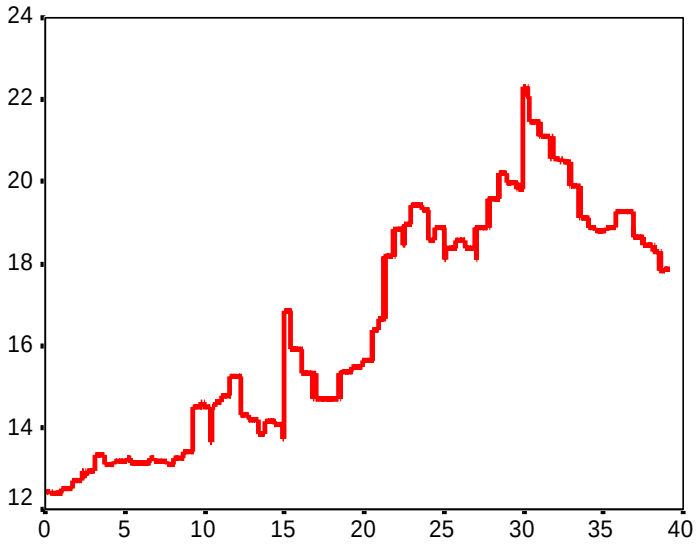
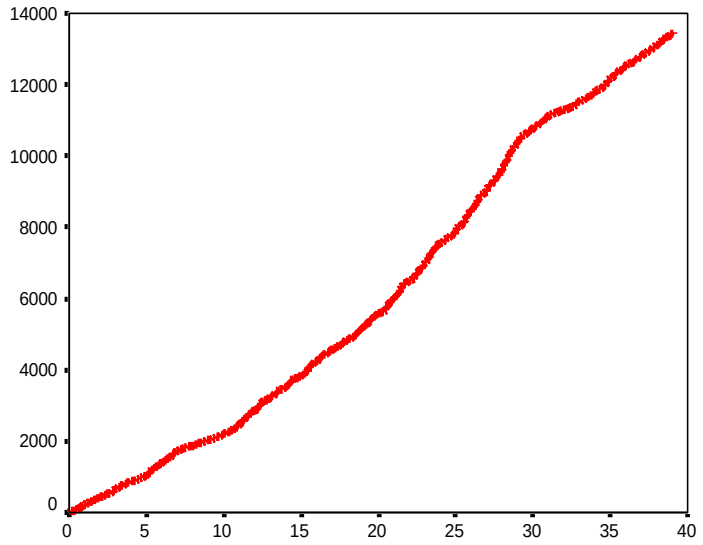
0 of 925 selected
STEMS
View table
Export to Excel
Q
R
RouteFinder1
Route_test2.
0 - 15
15 - 30
30 - 45
transport rout
road edges
buildings
hazard surfac
9.53 - 1
15.997
18.031
20.172
22.076
Table2
F_cost T_cost N_recnum N_travdir time_secs tot_time
0.000 4.664 221 TF 3.36 3.36
4.664 6.377 226 TF 1.23 4.59
6.377 16.092 236 TF 6.99 11.58
16.092 17.050 237 TF 0.69 12.27
17.050 17.553 238 TF 0.36 12.63
17.553 27.024 245 TF 6.82 19.45
27.024 27.528 250 TF 0.36 19.81
27.528 38.251 257 TF 7.72 27.53
38.251 38.972 258 TF 0.52 28.05
38.972 45.084 264 TF 4.40 32.45
45.084 45.595 265 TF 0.37 32.82
45.595 49.866 269 TF 3.08 35.90
49.866 51.282 276 TF 1.02 36.92
51.282 57.990 279 TF 4.83 41.75
57.990 60.521 281 TF 1.82 43.57
60.521 71.158 285 TF 7.66 51.23
71.158 79.395 290 TF 5.93 57.16
79.395 81.738 298 TF 1.69 58.85
81.738 92.307 304 TF 7.61 66.46
92.307 101.058 310 TF 6.30 72.76
101.058 101.246 311 TF 0.14 72.90
101.246 102.683 313 TF 1.03 73.93
102.683 112.687 314 TF 7.20 81.13
112.687 113.703 308 TF 0.73 81.86
113.703 115.014 309 TF 0.94 82.80
115.014 115.519 315 TF 0.36 83.16
115.519 122.911 316 TF 5.32 88.48
122.911 132.128 324 TF 6.64 95.12
132.128 132.901 327 FT 0.56 95.68
132.901 133.973 336 FT 0.77 96.45
133.973 134.603 337 FT 0.45 96.90
134.603 137.277 341 FT 1.93 98.83
134.603 137.277 341 FT 1.93 98.83
Charts
Layouts
Scripts
3D Scenes
Dialogs
PolyLine 6 1
PolyLine 7 1
PolyLine 8 1
PolyLine 9 1
PolyLine 10 1
PolyLine 11 1

Route_test 2. Summary statistics

	Mean	Median	Minimum	Maximum	Percentile 95	Std Deviation	Sum
	16.593	16.375	12.383	22.301	20.191	2.647	13456.635

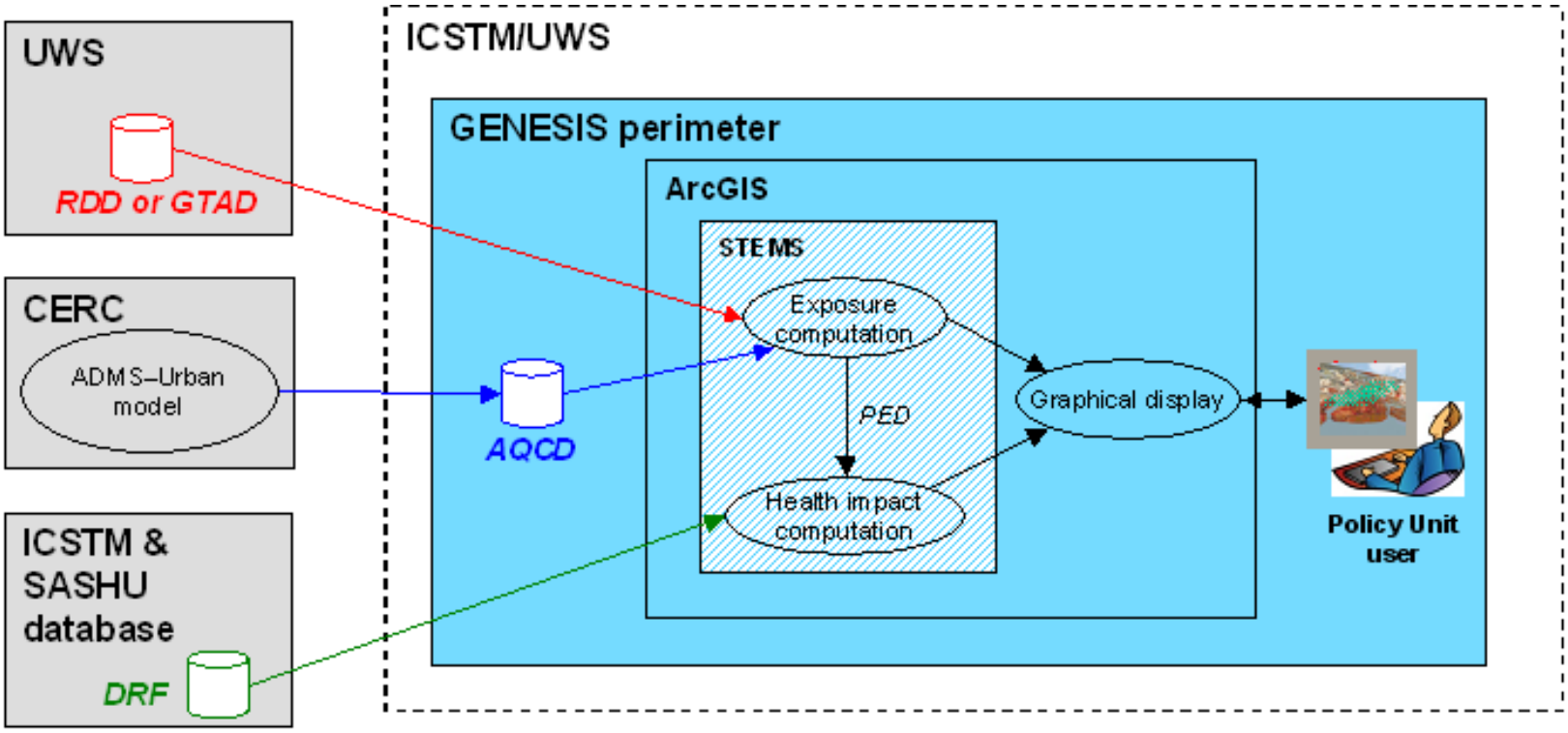




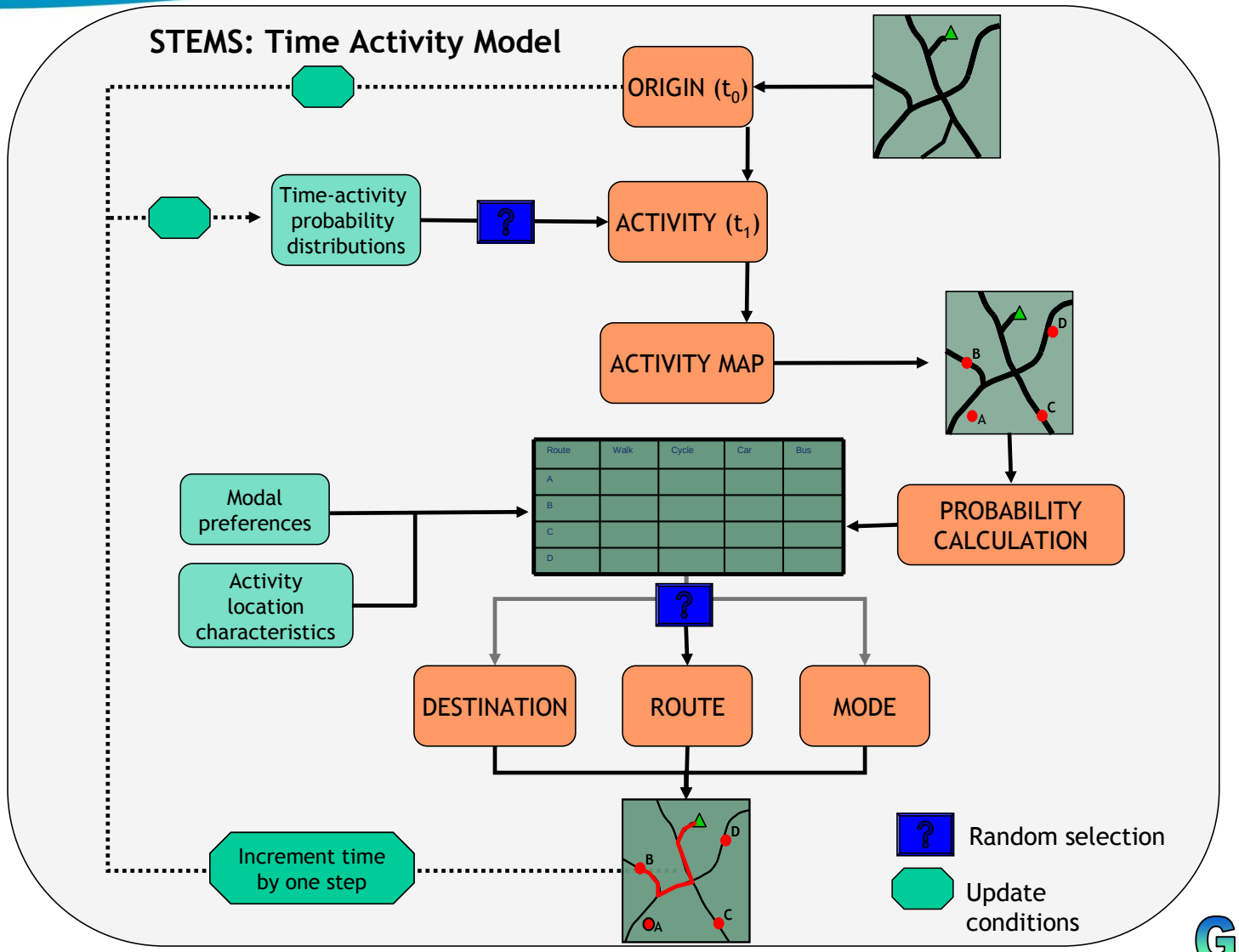
PolyLine	28	2	Stop 1	Stop 2	117.993
PolyLine	29	2	Stop 1	Stop 2	124.285
PolyLine	30	2	Stop 1	Stop 2	124.789
PolyLine	31	2	Stop 1	Stop 2	126.549
PolyLine	32	2	Stop 1	Stop 2	128.060
PolyLine	33	2	Stop 1	Stop 2	129.541
PolyLine	34	2	Stop 1	Stop 2	129.541
PolyLine	35	2	Stop 1	Stop 2	132.770

LONDON PILOT (AQ2, CERC/ICSTM/UWS WP2300)

UC1: Long-term exposure & health impact scenario



Existing technologies: STEMS

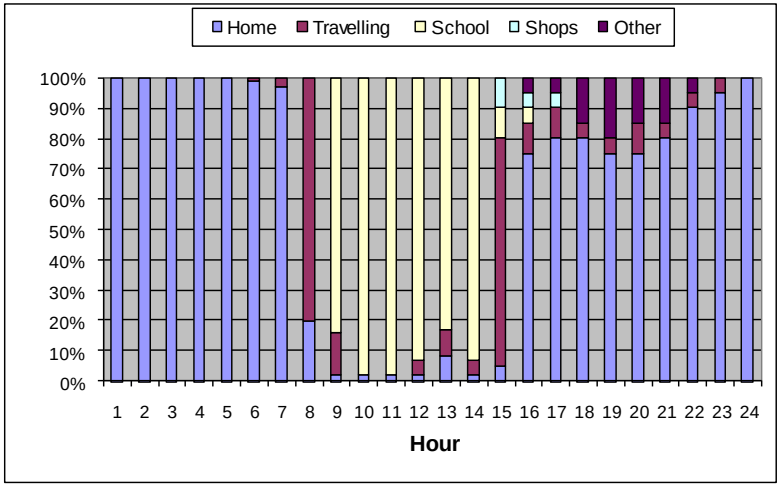


Existing technologies: STEMS

STEMS-Activity

GTAD

Probabilities based on national or local time-activity surveys



Example for child still at 'Home' at 08.15 → **Random = 0.6962**

Selected activity at time 08.30 = 'School';

therefore child is modelled as

travelling from home to school between 08.15 and 08.30;

the limited travelling time (<15 minutes) constrains the choice of destination

Time (end)	Home	School	Shops	Leisure	Travelling
08.00	0.00 - 0.85	0.85 – 0.87	0.87 – 0.89	0.89 – 0.90	0.90 – 1.00
08.15	0.00 - 0.75	0.75 – 0.82	0.82 – 0.84	0.84 – 0.85	0.85 – 1.00
08.30	0.00 - 0.65	0.65 – 0.75	0.75 – 0.79	0.79 – 0.80	0.80 – 1.00
08.45	0.00 - 0.30	0.30 – 0.60	0.60 – 0.65	0.65 – 0.70	0.70 – 1.00
09.00	0.00 - 0.02	0.02 – 0.90	0.90 – 0.90	0.90 – 0.90	0.90 – 1.00

GENESIS Consortium

What will be developed and by whom?

- [CERC] More detailed time resolution of input to concentration modelling e.g. near real time traffic data and increased concentration output e.g. series of hourly plots
- [UWS] Develop STEMS to make it operational, in a way that integrates with the GENESIS portal (possible parallel development in ArcGIS/ArcServer)
- [IT partners]
  - Data mining tools for large databases of various common formats
  - Definition of generic file formats
  - Rapid connection across the internet to datasets
  - Space-time co-registration tools
  - Make STEMS web-based
  - Possible output tools

The role of ICSTM

- Organise and implement field monitoring campaigns in London
- The results will be used to validate the use of STEMS with the high spatial-temporal resolution modelled concentration
- No new dose response function will be derived
- Health data at a level of a ward (~ 10,000 people) or less is not open for use
- ICSTM are involved in other projects in which the outputs are publicly available so there is likely to be synergy/added value

Why might it be of interest to the GLA?

- It will produce tools to calculate exposure and estimate health impacts of different air quality scenarios.
- By validating the system we can have confidence in testing out scenarios on the basis of air quality forecasts e.g. LEZ, Safer Routes to School etc.
- The tool is now at the demonstration stage

PROGRESS SO FAR

[1] Long term exposure calculated from residential locations and long term average concentrations

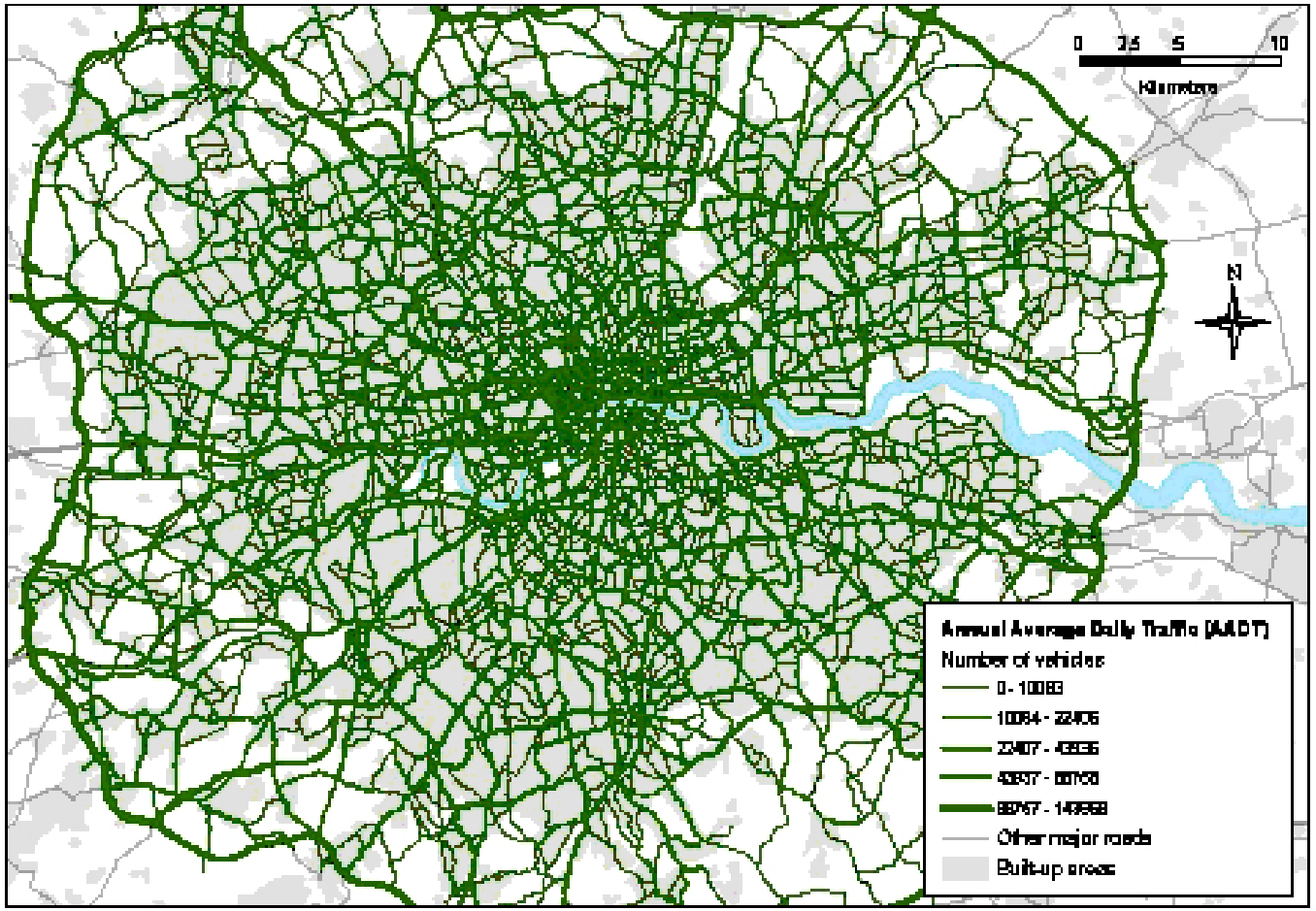
[2] Item [1] implemented in the GENESIS framework, ppt2

[3] Work on time-activity-transport mode being developed, ppt3

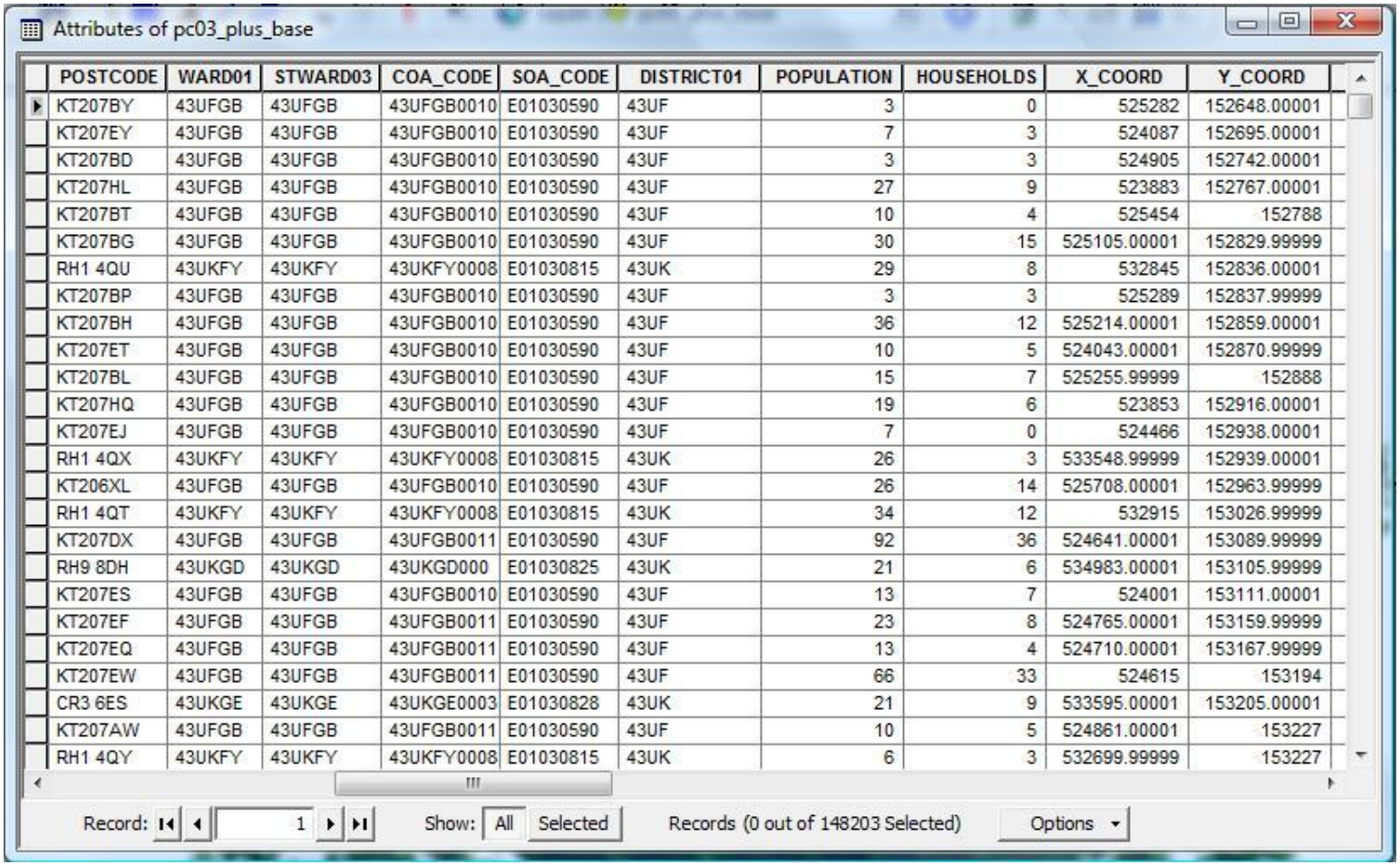
[4] Examples

- Tower Hamlets, pupils routes to school
- London-wide with/without LEZ

[1] ROAD NETWORK



[1] RESIDENTIAL DENSITY DATA



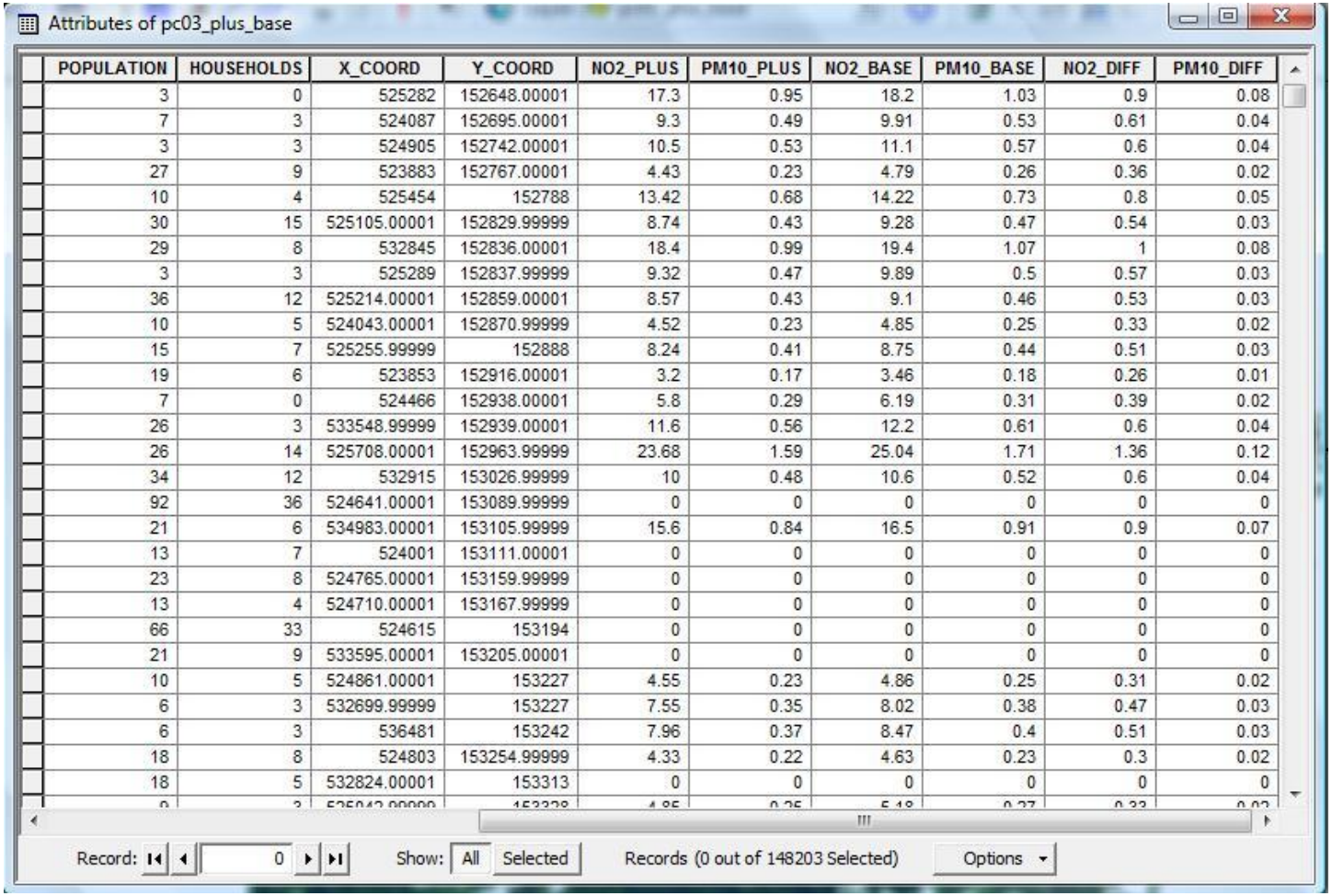
Attributes of pc03_plus_base

POSTCODE	WARD01	STWARD03	COA_CODE	SOA_CODE	DISTRICT01	POPULATION	HOUSEHOLDS	X_COORD	Y_COORD
KT207BY	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	3	0	525282	152648.00001
KT207EY	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	7	3	524087	152695.00001
KT207BD	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	3	3	524905	152742.00001
KT207HL	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	27	9	523883	152767.00001
KT207BT	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	10	4	525454	152788
KT207BG	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	30	15	525105.00001	152829.99999
RH1 4QU	43UKFY	43UKFY	43UKFY0008	E01030815	43UK	29	8	532845	152836.00001
KT207BP	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	3	3	525289	152837.99999
KT207BH	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	36	12	525214.00001	152859.00001
KT207ET	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	10	5	524043.00001	152870.99999
KT207BL	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	15	7	525255.99999	152888
KT207HQ	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	19	6	523853	152916.00001
KT207EJ	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	7	0	524466	152938.00001
RH1 4QX	43UKFY	43UKFY	43UKFY0008	E01030815	43UK	26	3	533548.99999	152939.00001
KT206XL	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	26	14	525708.00001	152963.99999
RH1 4QT	43UKFY	43UKFY	43UKFY0008	E01030815	43UK	34	12	532915	153026.99999
KT207DX	43UFGB	43UFGB	43UFGB0011	E01030590	43UF	92	36	524641.00001	153089.99999
RH9 8DH	43UKGD	43UKGD	43UKGD000	E01030825	43UK	21	6	534983.00001	153105.99999
KT207ES	43UFGB	43UFGB	43UFGB0010	E01030590	43UF	13	7	524001	153111.00001
KT207EF	43UFGB	43UFGB	43UFGB0011	E01030590	43UF	23	8	524765.00001	153159.99999
KT207EQ	43UFGB	43UFGB	43UFGB0011	E01030590	43UF	13	4	524710.00001	153167.99999
KT207EW	43UFGB	43UFGB	43UFGB0011	E01030590	43UF	66	33	524615	153194
CR3 6ES	43UKGE	43UKGE	43UKGE0003	E01030828	43UK	21	9	533595.00001	153205.00001
KT207AW	43UFGB	43UFGB	43UFGB0011	E01030590	43UF	10	5	524861.00001	153227
RH1 4QY	43UKFY	43UKFY	43UKFY0008	E01030815	43UK	6	3	532699.99999	153227

Record: 1 Show: All Selected Records (0 out of 148203 Selected) Options

GENESIS Consortium

[1] POINT EXPOSURE DATA


Attributes of pc03_plus_base

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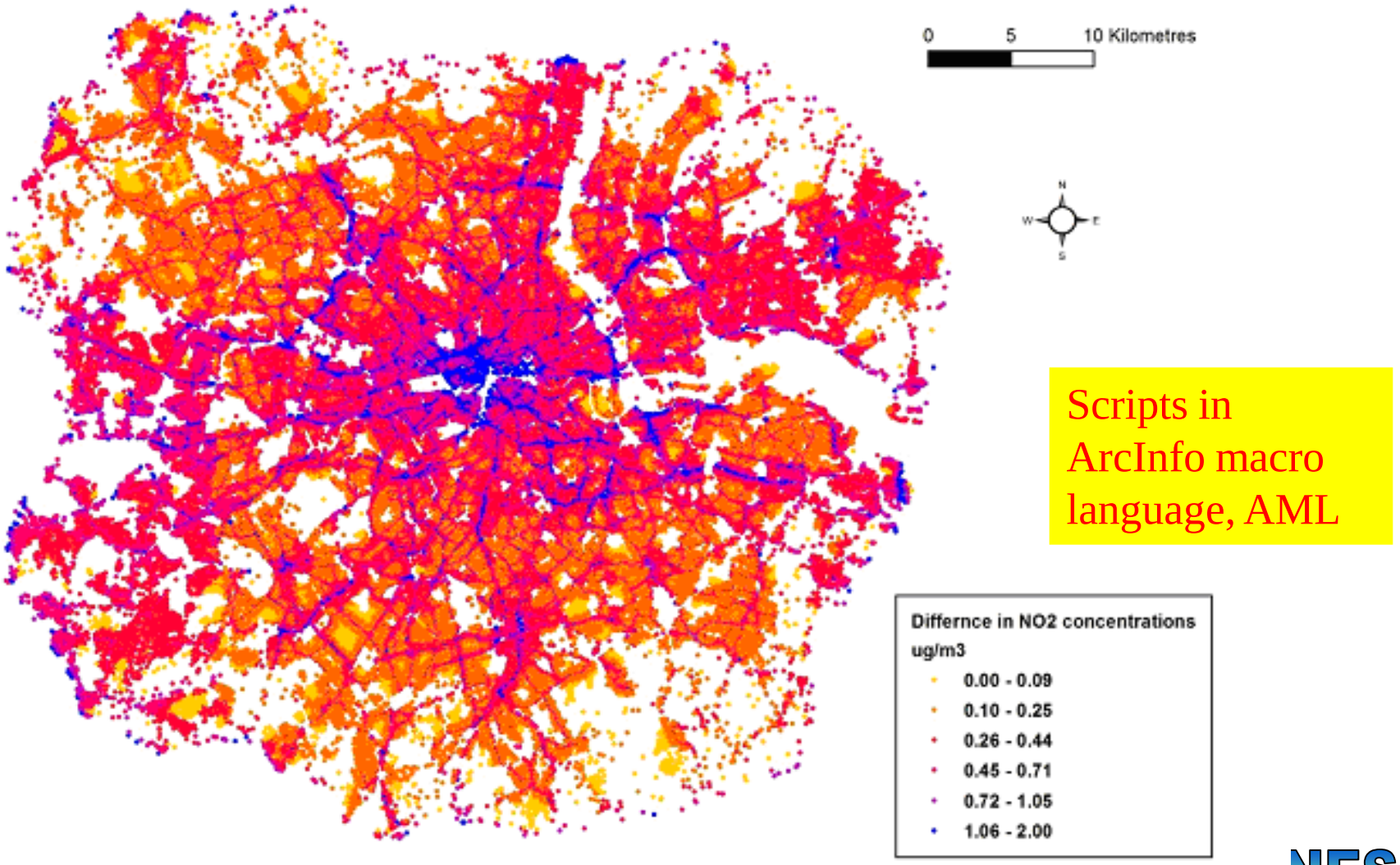
3	0	525282	152648.00001	17.3	0.95	18.2	1.03	0.9	0.08
7	3	524087	152695.00001	9.3	0.49	9.91	0.53	0.61	0.04
3	3	524905	152742.00001	10.5	0.53	11.1	0.57	0.6	0.04
27	9	523883	152767.00001	4.43	0.23	4.79	0.26	0.36	0.02
10	4	525454	152788	13.42	0.68	14.22	0.73	0.8	0.05
30	15	525105.00001	152829.99999	8.74	0.43	9.28	0.47	0.54	0.03
29	8	532845	152836.00001	18.4	0.99	19.4	1.07	1	0.08
3	3	525289	152837.99999	9.32	0.47	9.89	0.5	0.57	0.03
36	12	525214.00001	152859.00001	8.57	0.43	9.1	0.46	0.53	0.03
10	5	524043.00001	152870.99999	4.52	0.23	4.85	0.25	0.33	0.02
15	7	525255.99999	152888	8.24	0.41	8.75	0.44	0.51	0.03
19	6	523853	152916.00001	3.2	0.17	3.46	0.18	0.26	0.01
7	0	524466	152938.00001	5.8	0.29	6.19	0.31	0.39	0.02
26	3	533548.99999	152939.00001	11.6	0.56	12.2	0.61	0.6	0.04
26	14	525708.00001	152963.99999	23.68	1.59	25.04	1.71	1.36	0.12
34	12	532915	153026.99999	10	0.48	10.6	0.52	0.6	0.04
92	36	524641.00001	153089.99999	0	0	0	0	0	0
21	6	534983.00001	153105.99999	15.6	0.84	16.5	0.91	0.9	0.07
13	7	524001	153111.00001	0	0	0	0	0	0
23	8	524765.00001	153159.99999	0	0	0	0	0	0
13	4	524710.00001	153167.99999	0	0	0	0	0	0
66	33	524615	153194	0	0	0	0	0	0
21	9	533595.00001	153205.00001	0	0	0	0	0	0
10	5	524861.00001	153227	4.55	0.23	4.86	0.25	0.31	0.02
6	3	532699.99999	153227	7.55	0.35	8.02	0.38	0.47	0.03
6	3	536481	153242	7.96	0.37	8.47	0.4	0.51	0.03
18	8	524803	153254.99999	4.33	0.22	4.63	0.23	0.3	0.02
18	5	532824.00001	153313	0	0	0	0	0	0

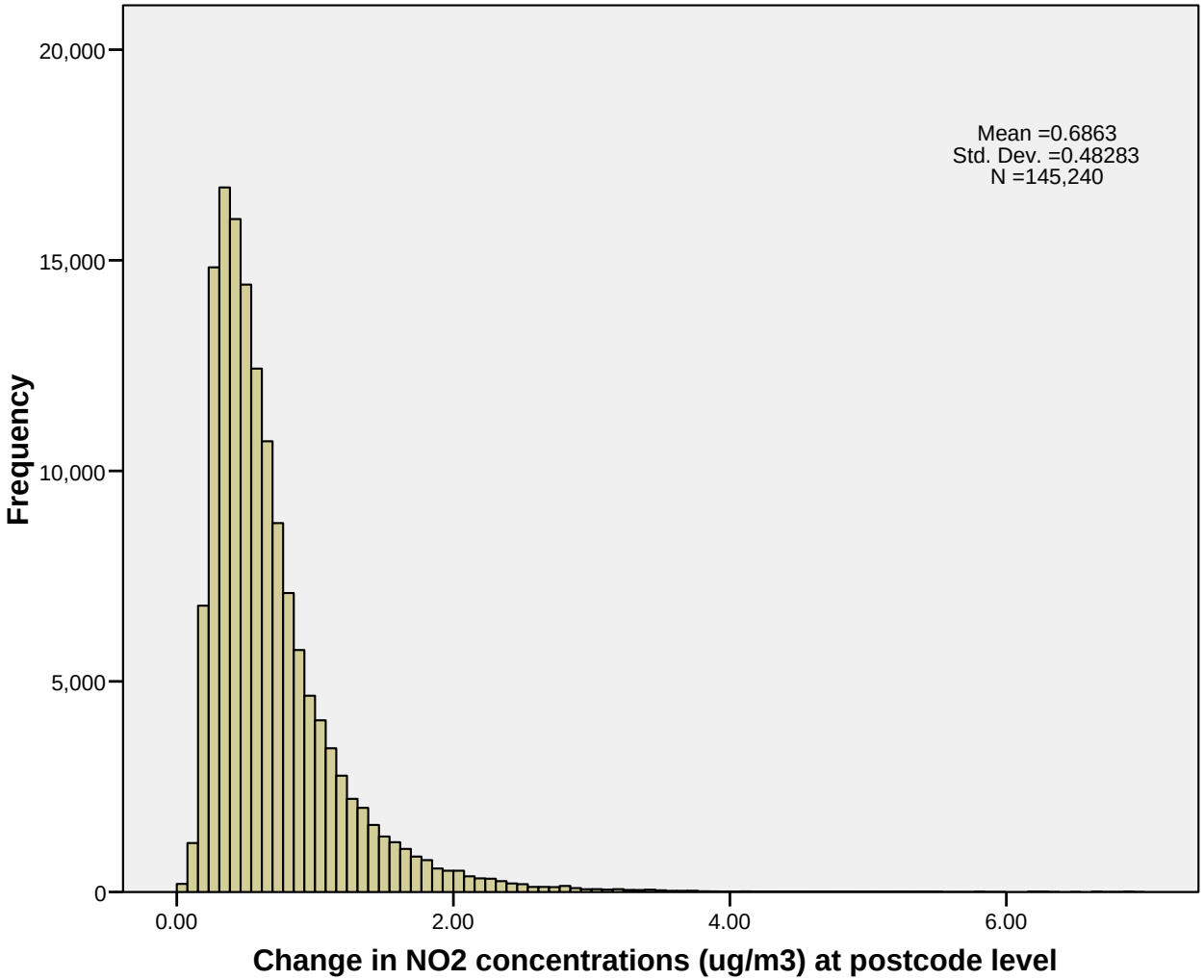
Record: 0 Show: All Selected Records (0 out of 148203 Selected) Options

GENESIS Consortium

[1] MAPPED DIFFERENCE IN NO2 EXPOSURE



[1] DIFFERENCE IN NO2 EXPOSURE



Change in NO_2 concentrations between the "without" scenario minus the "with" scenario for NO_2 concentrations at postcode level under the LEZ