



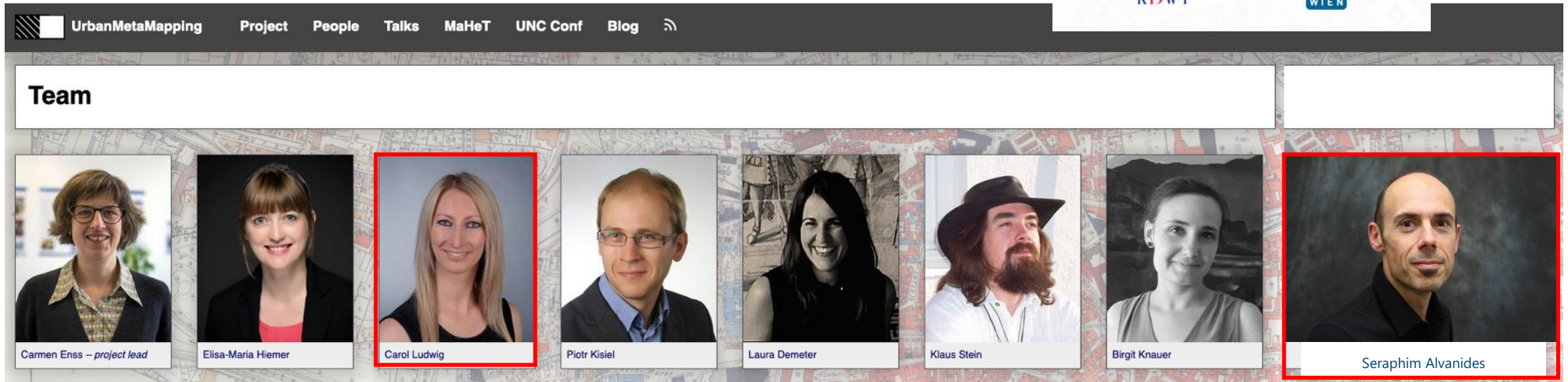
Applying Digital Humanities Methods to Historic Damage Maps

UMM Transfer Workshop, Bamberg, January 2025

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Universität des Saarlandes, Germany

Research Project and Central Questions



BMBF-Funded 4 Year Project: Mapping and Transforming: An interdisciplinary analysis of city maps as a visual medium of urban transformation in Central and Eastern Europe, 1939–1949

Subproject "Sozialkartographie" **employed geographical data science methods to explore specific forms of postwar urban and social transformation** in Nuremberg, Cologne, Essen and Duisburg.

1. How can the use of GIS inform new questions and advance understanding of post-war transformation?
2. To what extent has the level of destruction in postwar cities influenced the subsequent land-use mix, urban morphology, spatial concentration of heritage and the later socioeconomic profile of the cities explored?

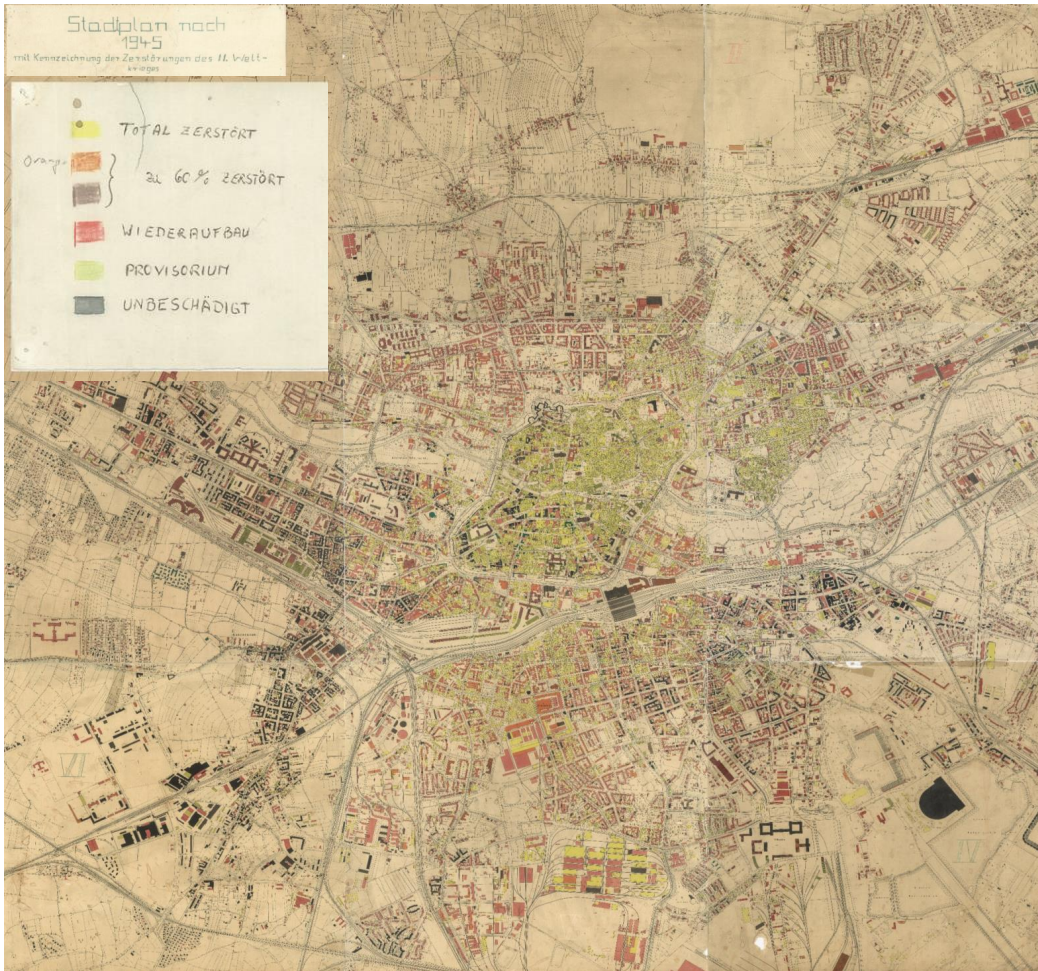
GEFÖRDET VOM

Key Data Sources: Paper Maps (various types)

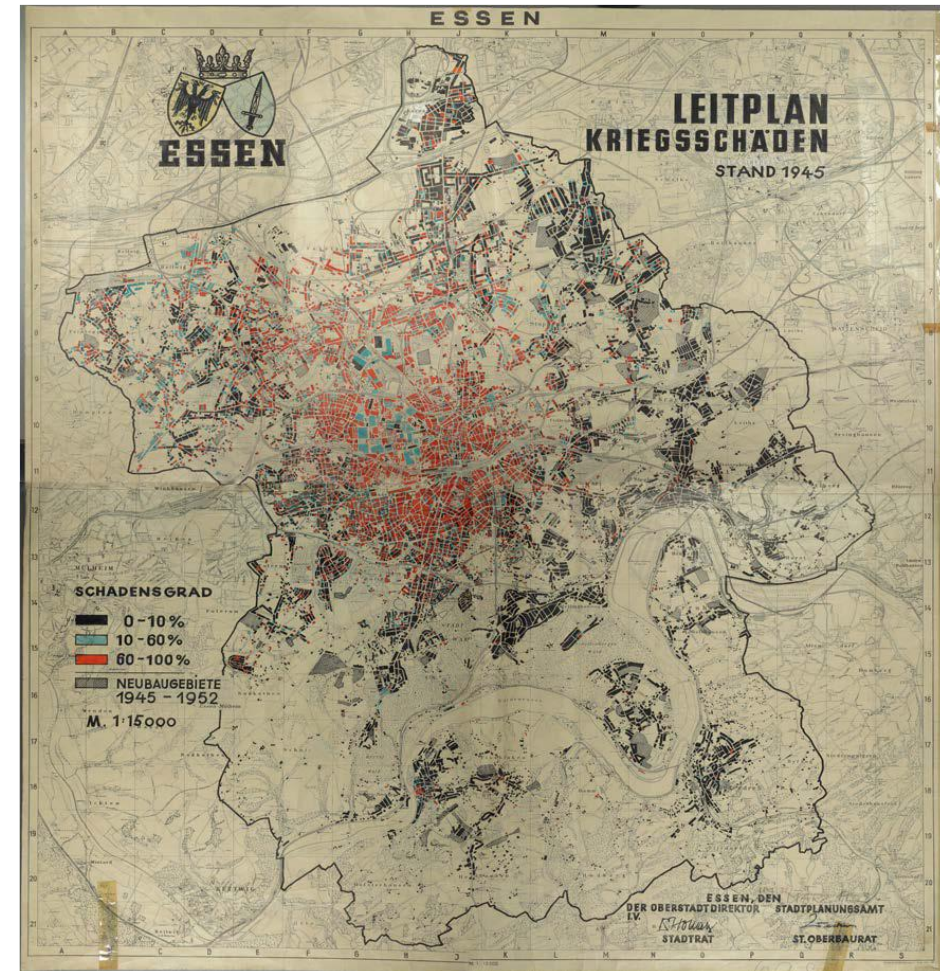
- Using a Geographical Information System (GIS) to capture and display maps digitally
- Georeferencing
- Depicting features found in historical maps digitally
- Enable visual and spatial analysis



Examples of Damage Maps (city extent)

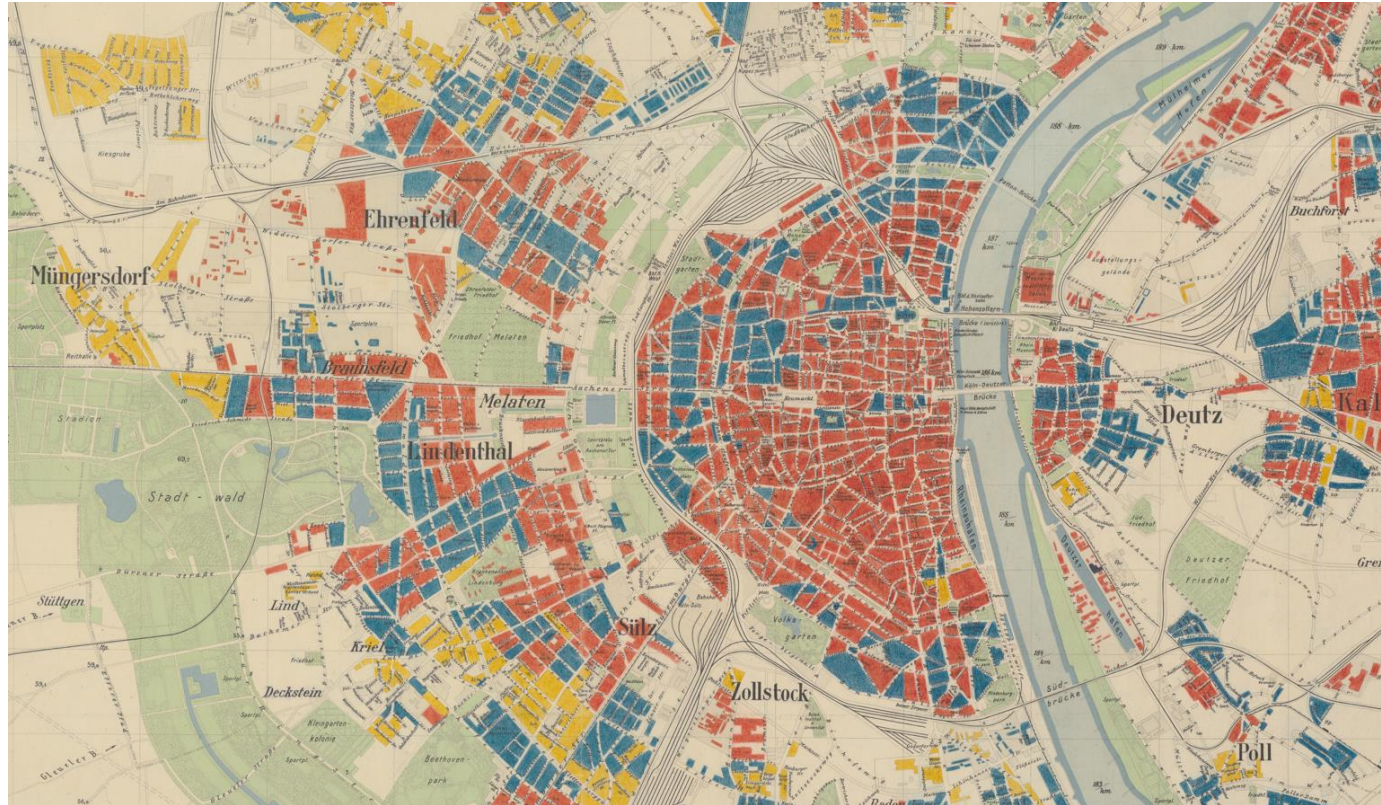


Nuremberg Damage Map „Stadtplan nach 1945“ (1950), Stadtplan nach 1945:
StadtAN: A4_V_152

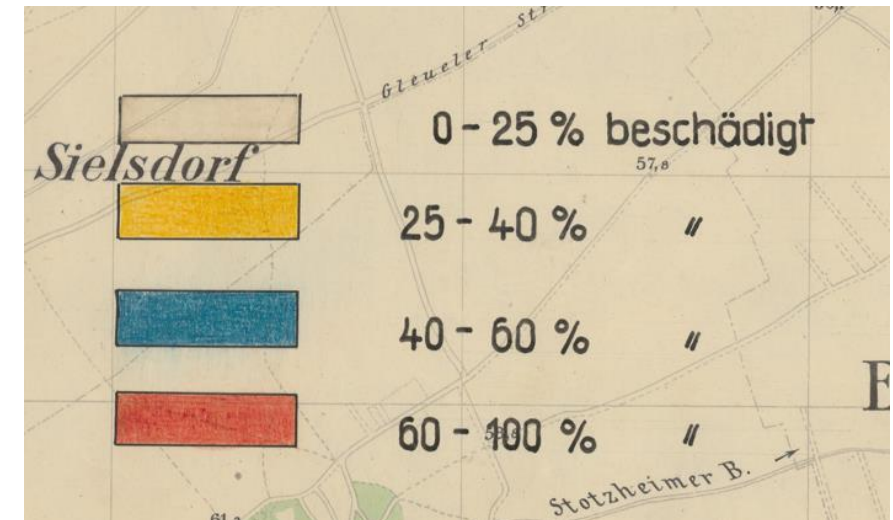


Damage map of Essen (1952, drawn on 1945 basemap),
Stadt Essen Bestand 901, Nr. 698.

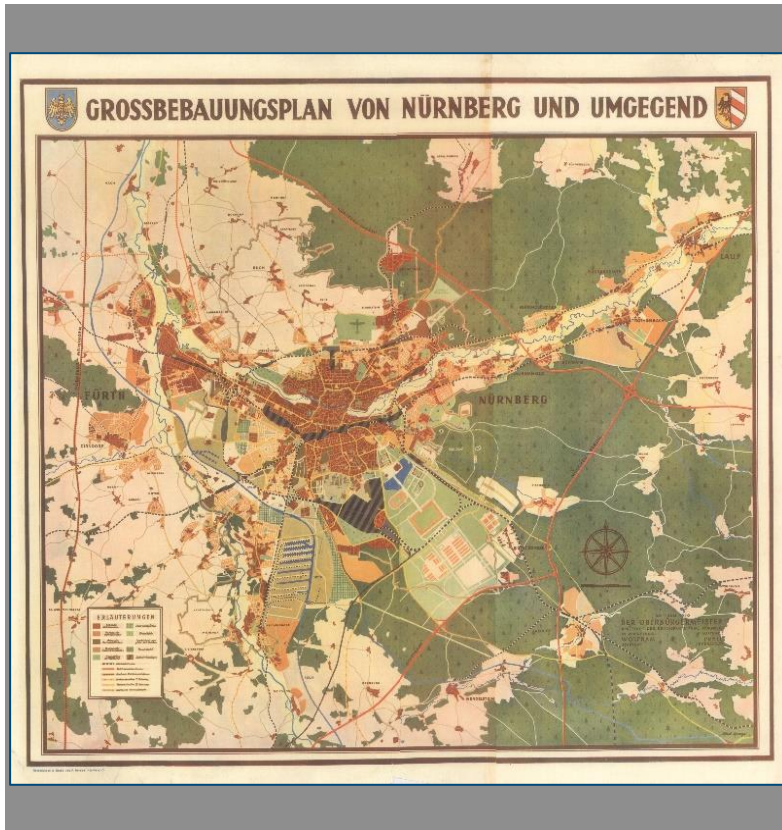
Examples of Damage Maps



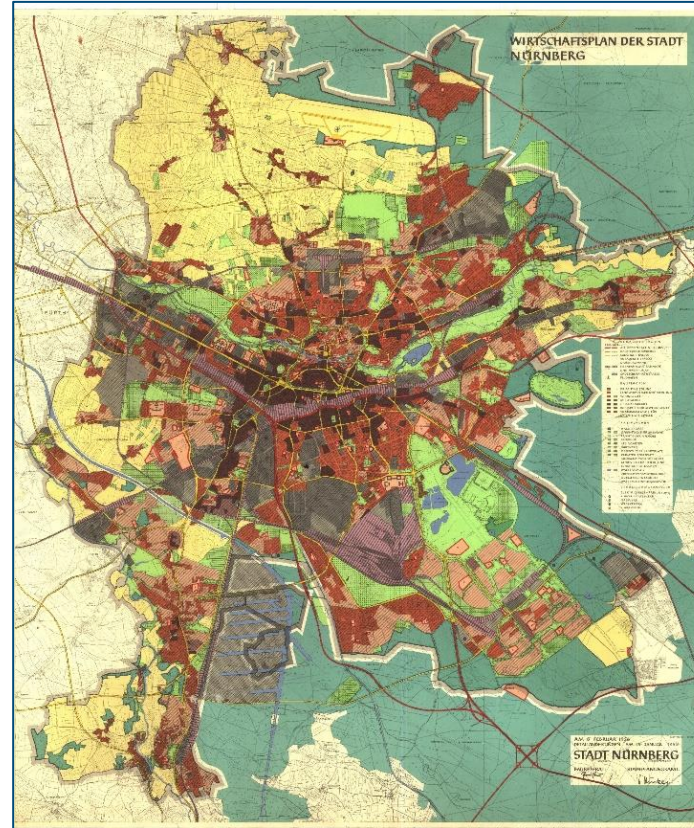
Map of the city of Cologne. Damage plan as at the end of 1945, Landesarchiv NRW, RW Karten, Nr. 4207



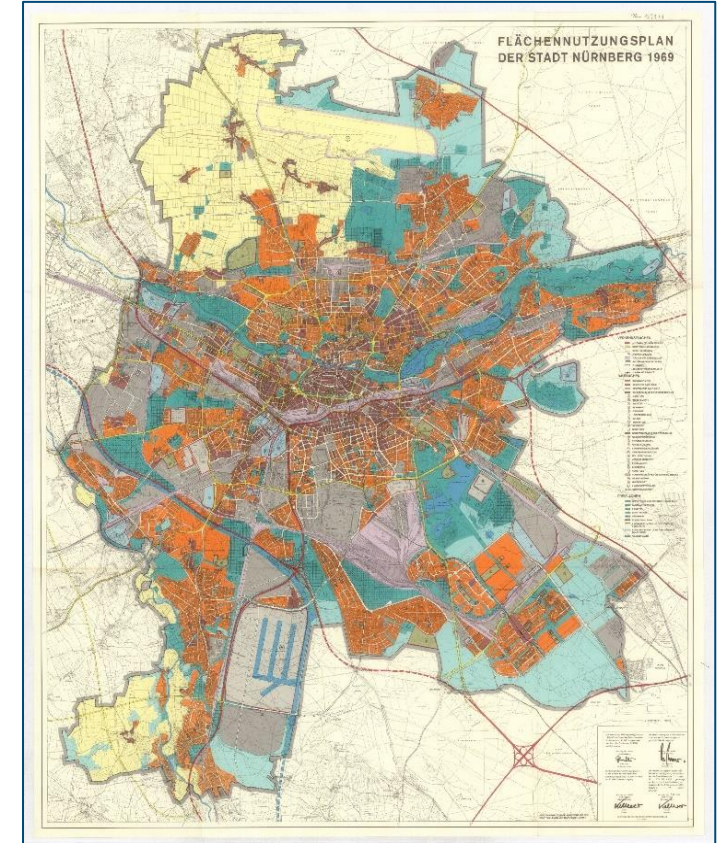
Examples: Historical Maps of Land-use/cover: 1940, 1956, 1969



1940 Development Plan. Source: StadtAN: A 4/V Nr. 794



1956 Economic Plan. Source: StadtAN: A 4/VII Nr. 2710



1969 Landuse Plan. Source: StadtAN: A 4/V Nr. 321

How can the use of **GIS** inform **new questions** and **advance understanding** of **post-war transformation**?

What did we do with these historic maps?



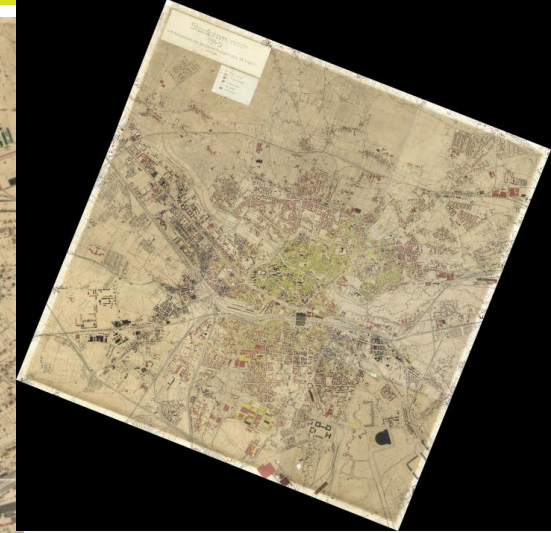
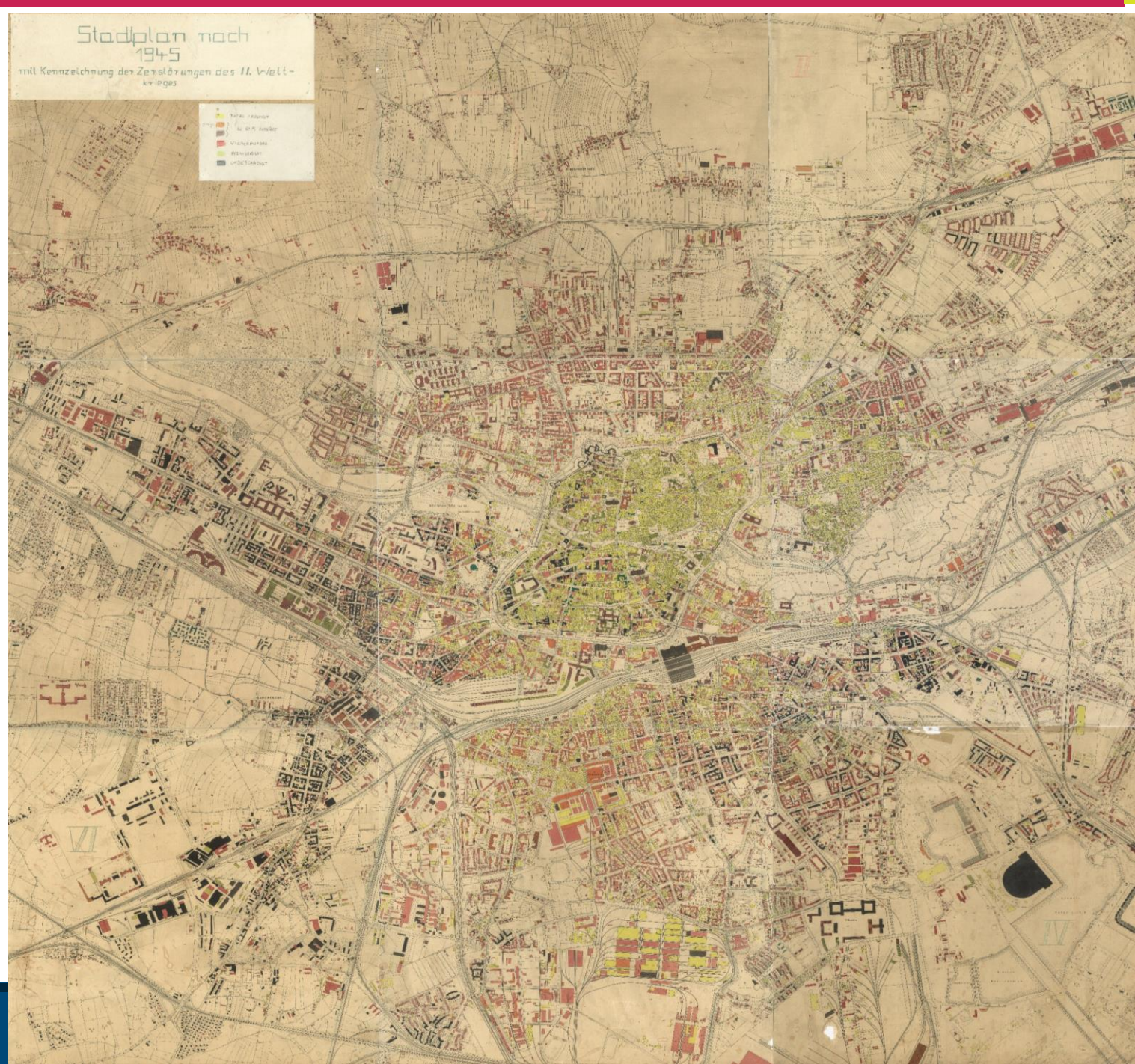
Transformation From Various Perspectives:
Urban: Bomb Damage, Urban Morphology, Landuse, Heritage
Social: Socioeconomic Change



Urban Transformation 1: Bomb Damage



Transformation 1: Bomb Damage



Georeferencing,
Ground Control Points (city wall)

Nuremberg
Damage Map
„Stadtplan
nach 1945“
(1950)

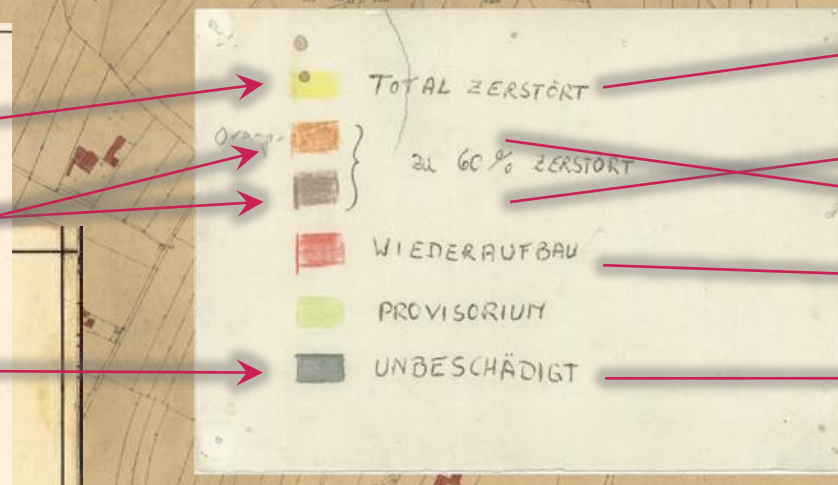
Interpreting the Map Legend



Continuum of Damage?

Erläuterung:

	total beschädigt.
	schwer beschädigt.
	leicht oder mittel beschädigt.
	unbeschädigt.
	ausgebrannt, Außenmauerteile leicht beschädigt.
	ausgebrannt, Außenmauerteile schwer beschädigt.
	Mauerteile, die einzustürzen drohen.
	schwer beschädigt, aber Außenmauerteile noch gut erhalten.



Complete ~10

Heavy ~7

Medium ~5

Slight ~3

Intact ~1

Capturing the Level of Destruction: District Level



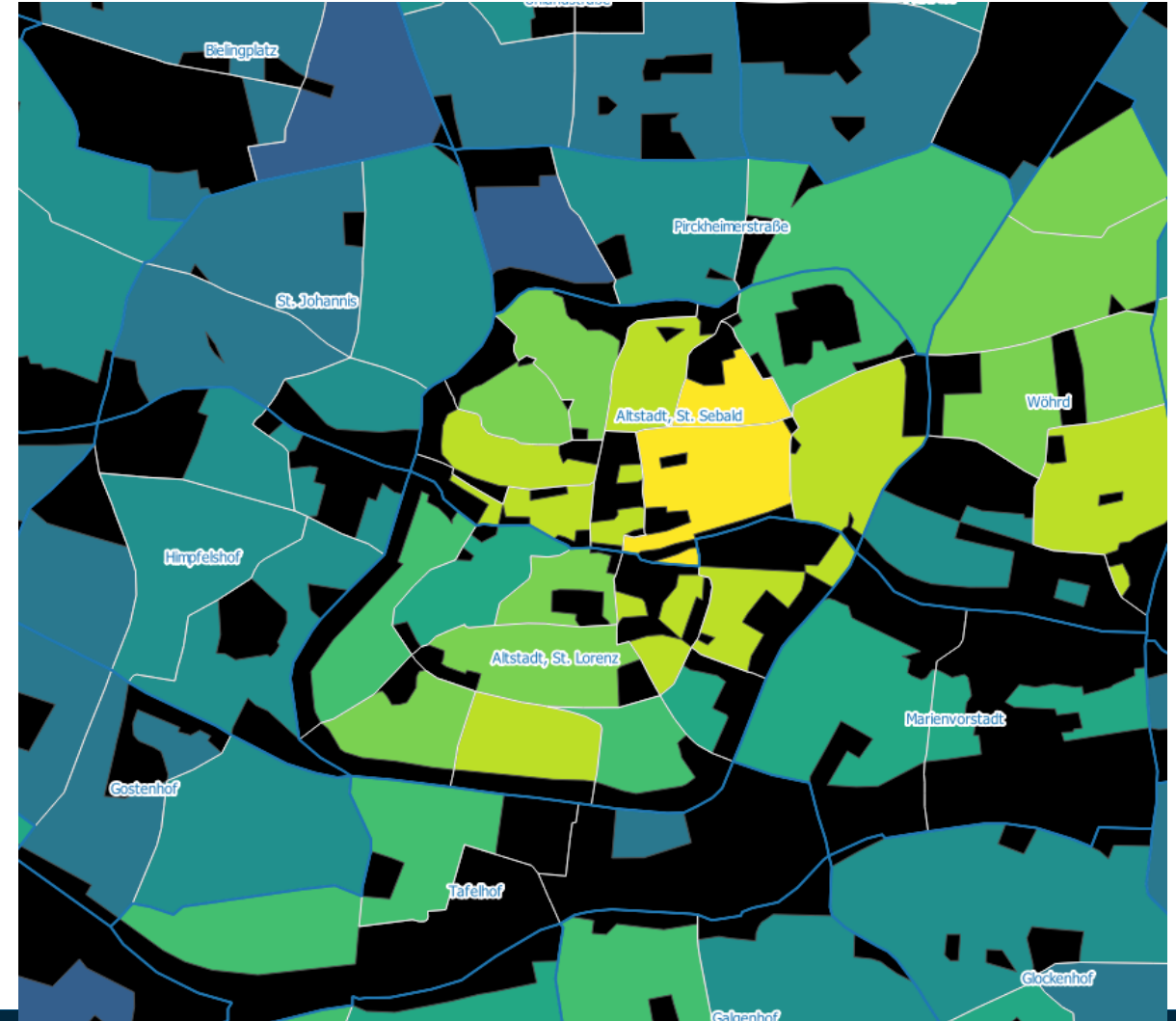
Stadtplan nach 1945: StadtAN: A4_V_152

316 Districts

Spatial Unit of Analysis? Automated Methods?

KRG	KRG_BEZ		KRG	KRG_CITY	Shape_Len	Shape_Ar	Black	Red	Yellow	Orange	GREEN	BROWN	Sum[f]	Sum	if not 100 [f]
10	'St. Lorenz (Adlerstr.)'		10	9.56E+09	1004.474	52995.03	10	15	69	1	5	0	100	100	
11	'St. Lorenz (Josephspl.)'		11	9.56E+09	1317.778	75692.15	25	15	54	0	5	1	100	100	

Visualizing the Level of Destruction



The bomb damage/destruction index (BDI) at the District level, with bright yellow recording the highest values of damage, blue recording lower values and Districts in black recording no damage (BDI=0). Source: District boundaries from *Amt für Stadtforschung und Statistik (2021)*

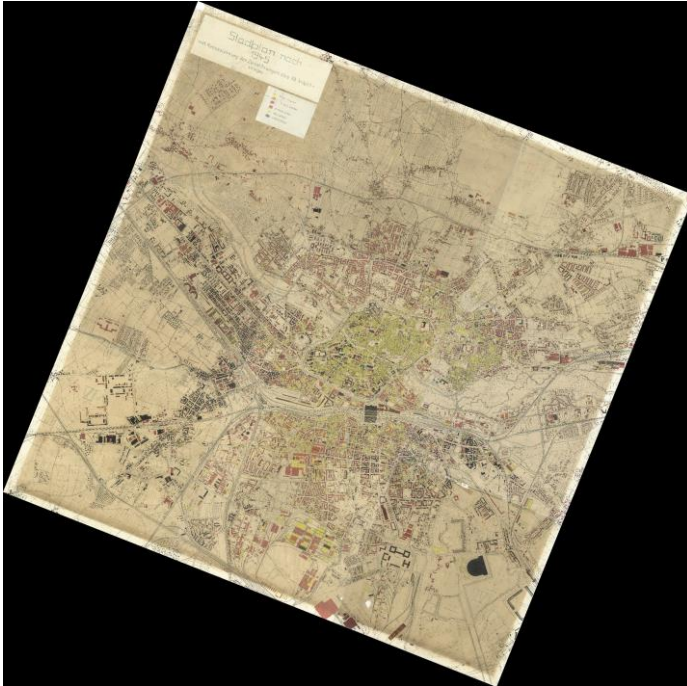
To what extent has the **level and spatial variation** of **destruction** in postwar cities influenced the later development of those cities?



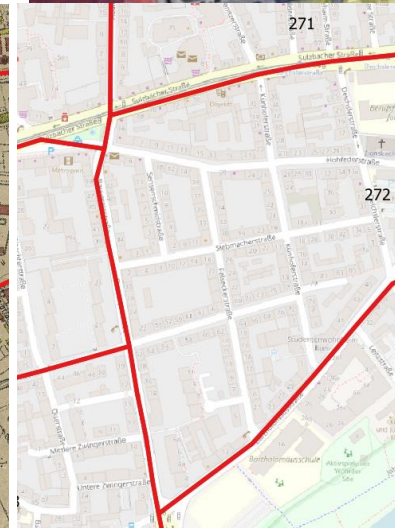
Urban Transformation 2: Urban Morphology (Block Typologies)



Digitizing the Historic Blocks



Stadtplan nach 1945: StadtAN:
A4_V_152



OpenStreetMap and satellite
imagery to categorize
present-day blocks (top right)

Categorising Pre-war and Present-day Urban Block Typologies



I. Tight

Typically, **street-oriented**, **high density** and high interconnectedness. Smaller individual plots, mixed land uses, more flexibility to change with the urban fabric over time, **traditional blocks**, **rows**, **courtyards**.



II. Loose

Typically, **inward-oriented**, **lower density**, **distinct spatial bounding from surrounding urban area**, larger plots, lower variety of land use, ribbons, groups, **"estate based"** housing.



III. Solitaire

Solitaires are similar to the loose morphology in that they are less street-oriented than tighter urban morphologies. This typology however refers to **singular buildings such as free-standing high rises**.



IV. Exceptional

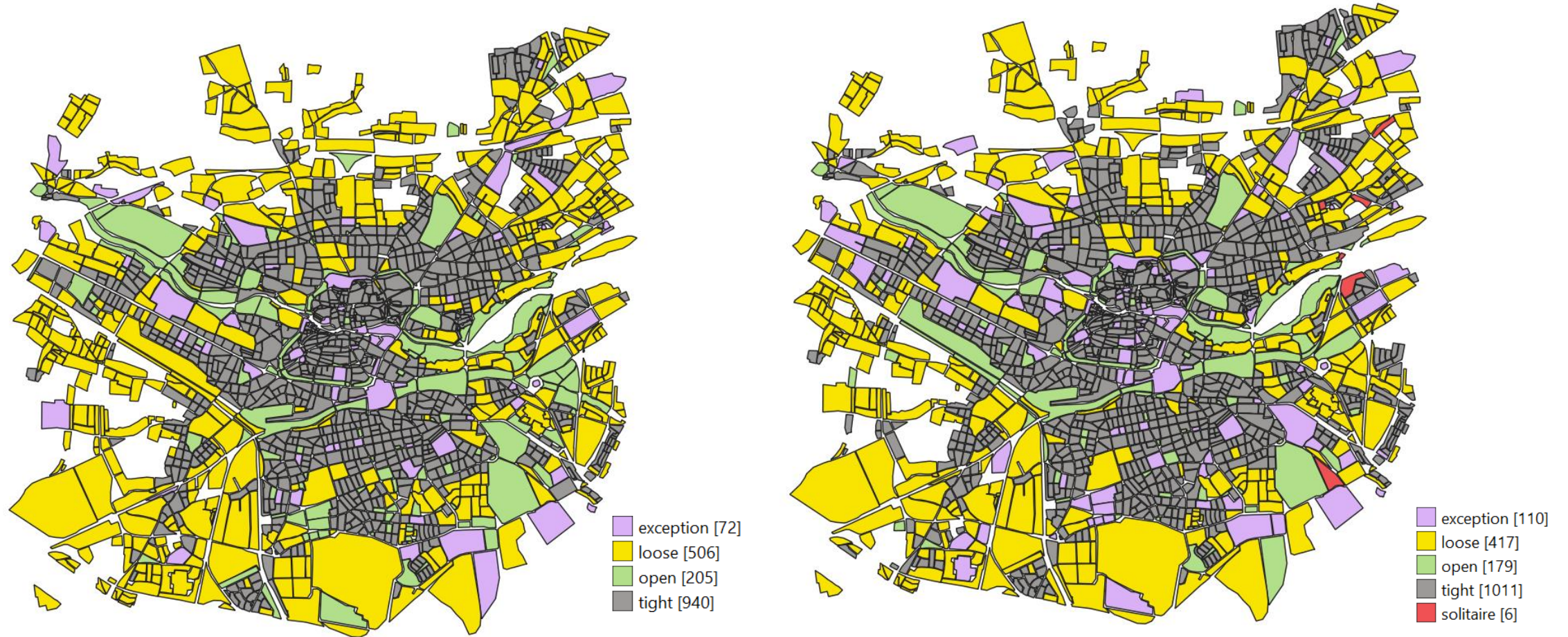
This typology refers to blocks that are **discontinuous with the urban fabric**, such as large schools, churches, warehouses, stations, and shopping malls. Typological examples include solitaires (excluding those from III.) and sheds.



V. Open

Open space includes both green spaces such as parks and unbuilt lots as well as built-up spaces such as public plazas.

Change by Typology: 1940s vs Present



High degree of urban morphological integration, evident in the overall continuity of the urban block typologies (especially towards the centre and inner city of Nuremberg), rather than a radical break with the historical arrangement of the urban fabric of the city. Damage created opportunity/impetus for change. Nuremberg opted for a more traditional postwar planning strategy, building broadly on old ground plan.

From a town planning perspective, this period was characterized by principles of lower density, opening-up blocks, maximising daylight, ventilation, while making favourable conditions for the automobile.

Consistent Typology but Lower Density Development.

Historic Block Typologies ca. 1940

Modern Block Typologies (2022)

Urban Transformation 3: Heritage

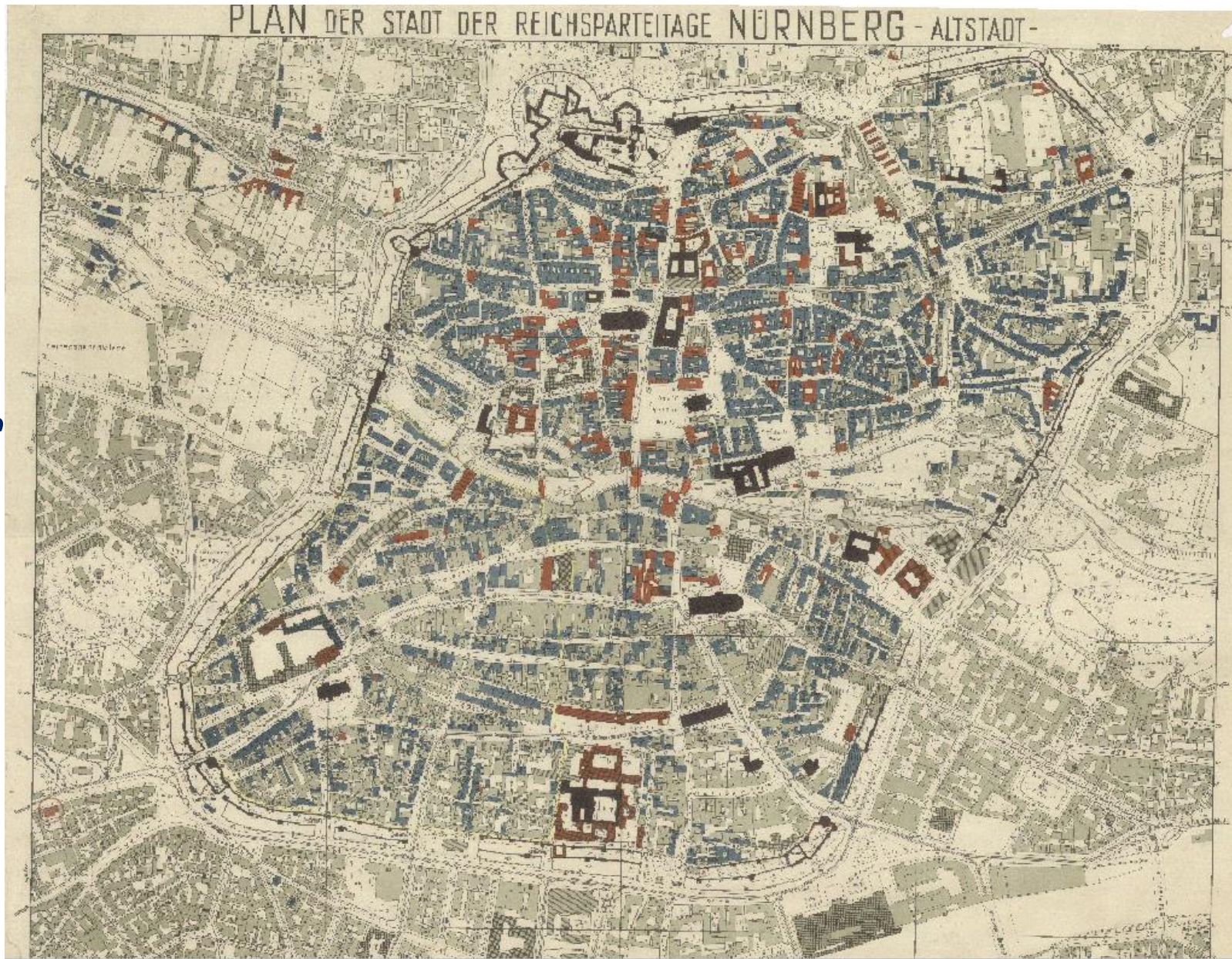
How did the Second World War transform the heritage fabric of Nuremberg's Old Town?

*Spatial Arrangement/Distribution of Heritage.
*Destiny of Individual Buildings.



Denkmalwert-
stufenkarte,
1:2000, 1940s
(1943?)

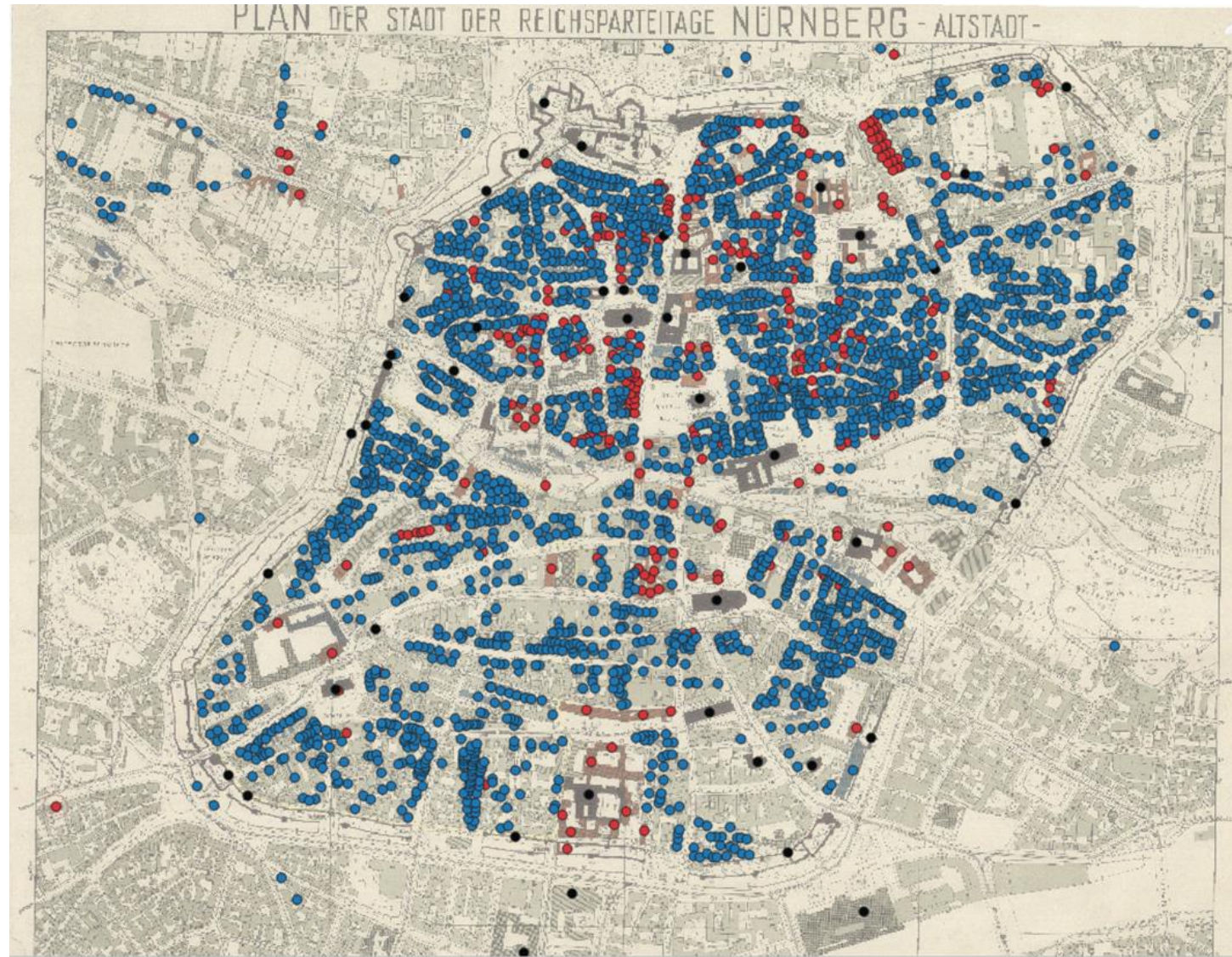
*(Monument
Heritage Value
Map)*



The map shows
heritage value
categories in
different colour
codes:
"most historically
valuable" (black),
"historically
valuable" (red) and
"historic" buildings
(blue).

(Presumably created by the
*Department for the Protection
of Monuments in the Office of
Structural Engineering*)

Pre-war Heritage Assets (1940s)

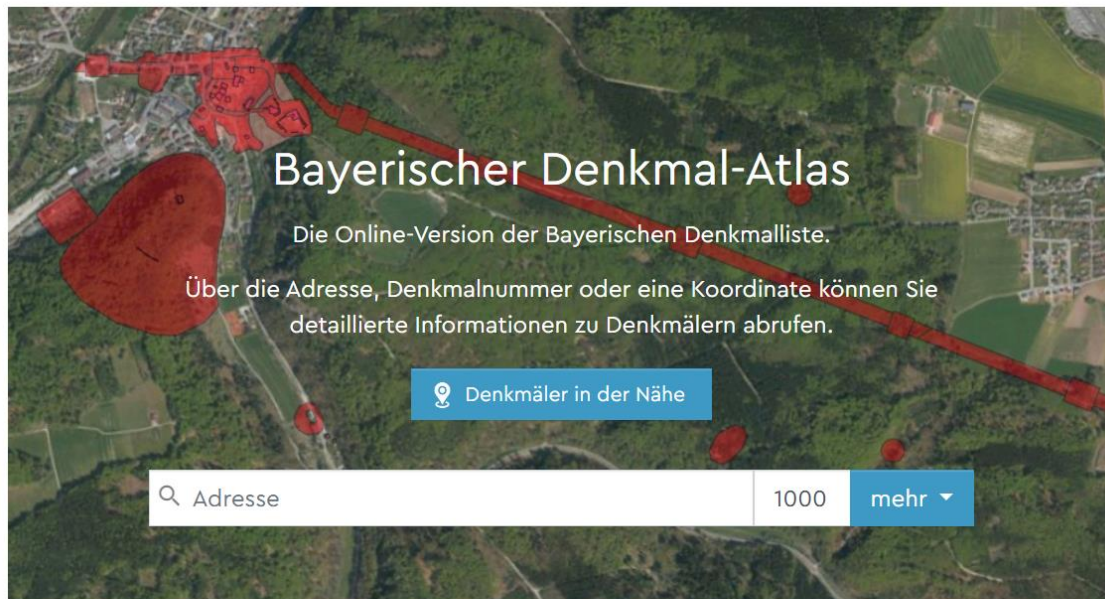


Methodological Steps:
Map scanned.
Georeferenced in
QGIS.
Digitised- Vectorised
(points)
Geodata Tabulated.

The map shows heritage value categories in different colour codes:
"most historically valuable" (black), "historically valuable" (red) and "historic" buildings (blue).
Total Number of "Heritage Assets": 2852

Source: Stadtarchiv Nürnberg, A 4/X, 210

Present-Day *List of Heritage Assets* (Denkmalliste)



SUCHE NACH
DENKMÄLERN

BAYERN-ATLAS
MIT DENKMALDATEN

DENKMALLISTEN
ZUM DOWNLOAD

INFOS ZUM
DENKMAL ATLAS

D-5-64-000-1077 **Nähe Wöhrder Wiesenweg.** Brunnenanlage, sog. Meer Gottbrunnen, Bronzegruppe mit der Darstellung eines Triton auf einem Hippokamp, 1913, Teilkopie nach einem Neptunbrunnen des 17. Jh., moderne Aufstellung.
nachqualifiziert

D-5-64-000-2459 **Namslauer Straße 7; Namslauer Straße 9; Namslauer Straße 11.** Kath. Gemeindezentrum Zum Guten Hirten: Pfarrkirche, sechseckiger Zentralbau mit Ziegelmauerwerk, horizontal verstärkenden Betonrippen, farbverglaste Lichtschlitzen und flachem Zeltdach; mit Ausstattung von Egino Weinert; Pfarramt und Gemeindesaal mit Pfarrbücherei, erdgeschossige, um einen Innenhof gruppierte Ziegelbauten mit Flachdach, über vorkragenden Laubengang miteinander verbunden; Pfarrkindergarten, hufeisenförmiger, erdgeschossiger Ziegelbau mit Flachdach; Vorhof zwischen Kirche und Gemeindezentrum, mit schlankem Betonmast mit Kreuz; sämtlich von Dr. Winfried Leonhardt und Peter Leonhardt, 1960/61.
nachqualifiziert

D-5-64-000-1386 **Nerzstraße 23 b.** Martersäule, Aufsatz mit Kreuzigungsrelief, Sandstein, neu errichtet von Julius Lincke, 1942; bei der Lutherkirche (Südtiroler Platz 20).
nachqualifiziert

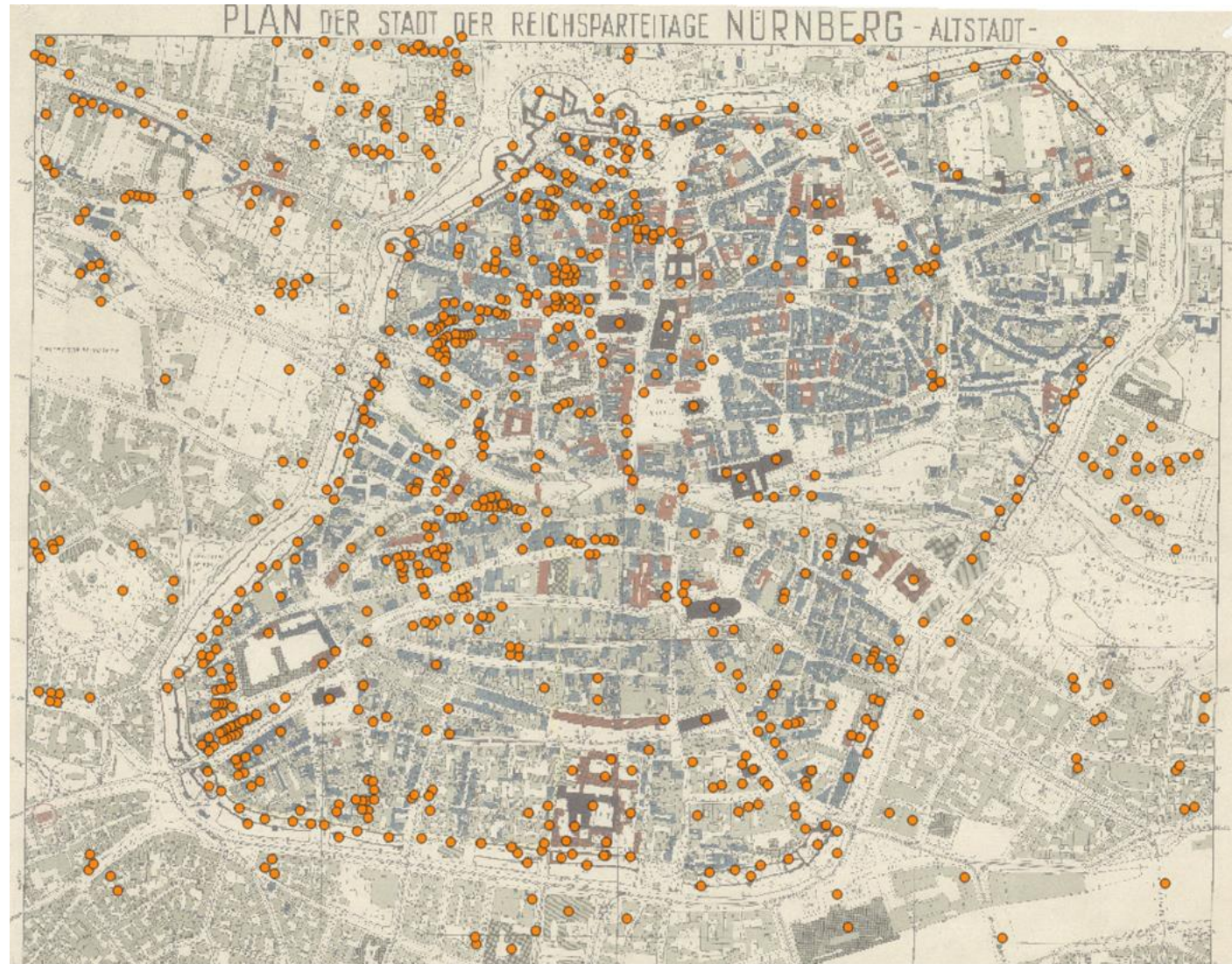
D-5-64-000-1387 **Neudörferstraße 15.** Mietshaus, dreigeschossiger Mansardwalmdachbau mit Sandsteinfassaden und Zwerchhaus, Neurenaissance, von Johann Roth, bez. 1884/85, im Inneren entkernt; bauliche Einheit mit Flaschenhofstraße 10.
nachqualifiziert

D-5-64-000-2330 **Neumeyerstraße 47.** Gnadenkirche, Notkirchenbau, eingeschossiger Holzbau mit Oberlichtgaden und Walmdach, hölzerner Fachwerk-Glockenstuhl, rückseitig eingeschossiger langgestreckter Nebenbau mit flachem Walmdach, 1951 von Otto Bartning durch brüderliche Hilfe der Lutherischen Kirche Dänemarks erbaut.
nachqualifiziert

Present-day „Heritage Assets“ are documented with a code and description. Geodata containing polygons of each entry is held by the Bayerisches Landesamt für Denkmalpflege.

© Bayerisches Landesamt für Denkmalpflege Seite 221/345 Baudenkmäler - Stand 15.10.2022. Source: <https://geoportal.bayern.de/denkmalatlas/> and https://www.geodaten.bayern.de/denkmal_static_data/externe_denkmalliste/pdf/denkmaliste_merge_564000.pdf (19.06.2023)

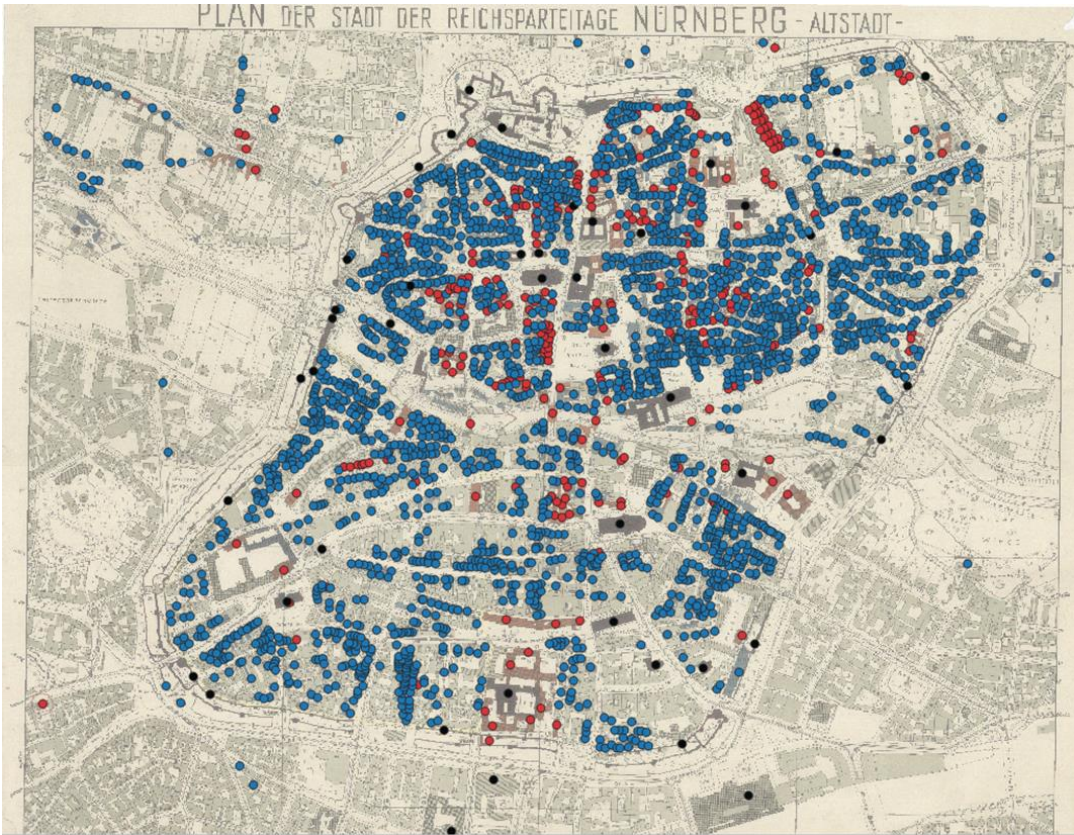
Present-Day Heritage Assets



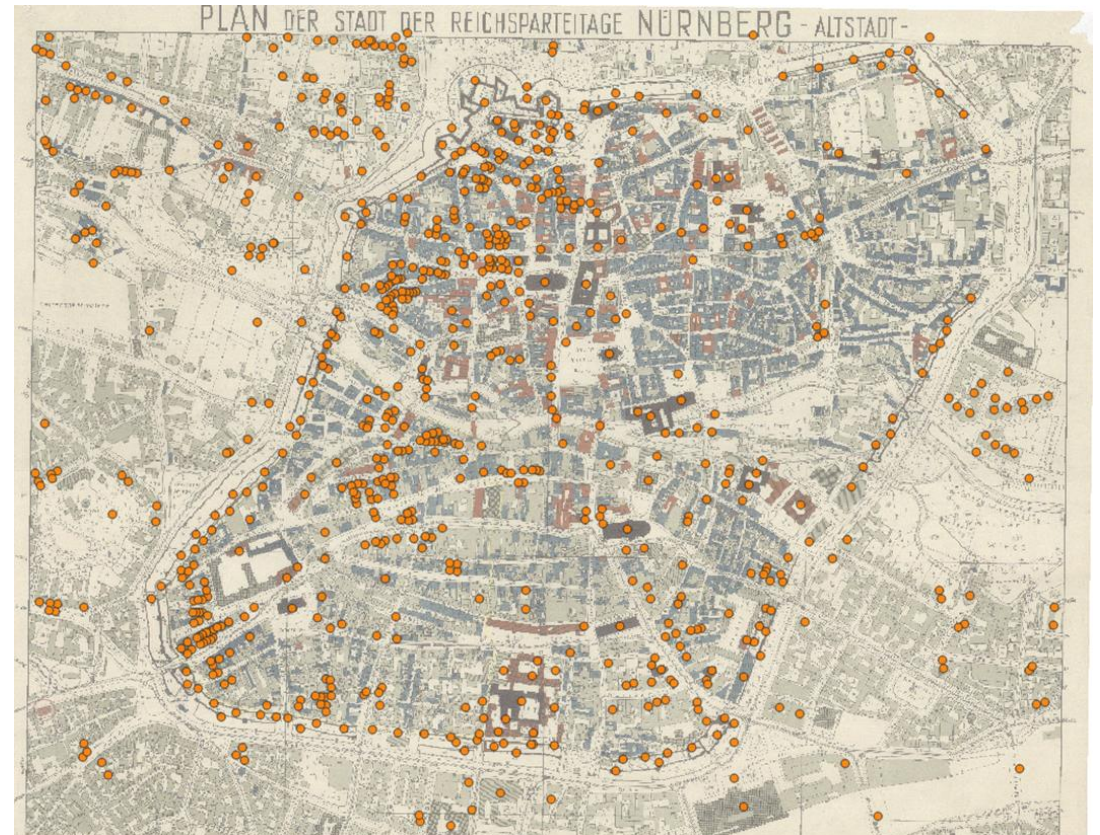
Geodata received from the Bayerisches Landesamt für Denkmalpflege
Total Number of "Heritage Assets" covering same areal extent as 1940s map: 800 (2052 less)

Source: Stadtarchiv Nürnberg, A 4/X, 210

Present-Day Heritage Assets



1943

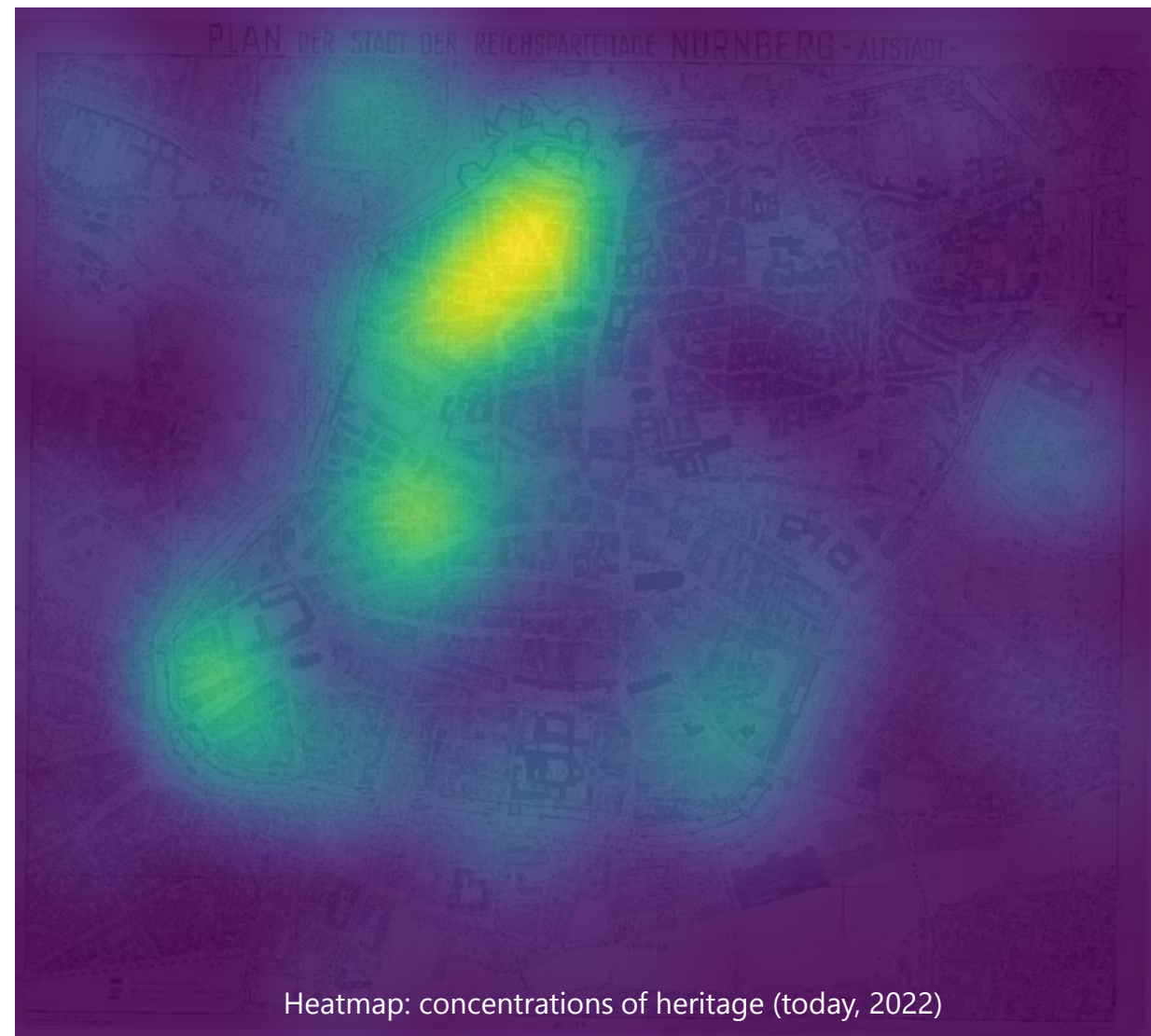
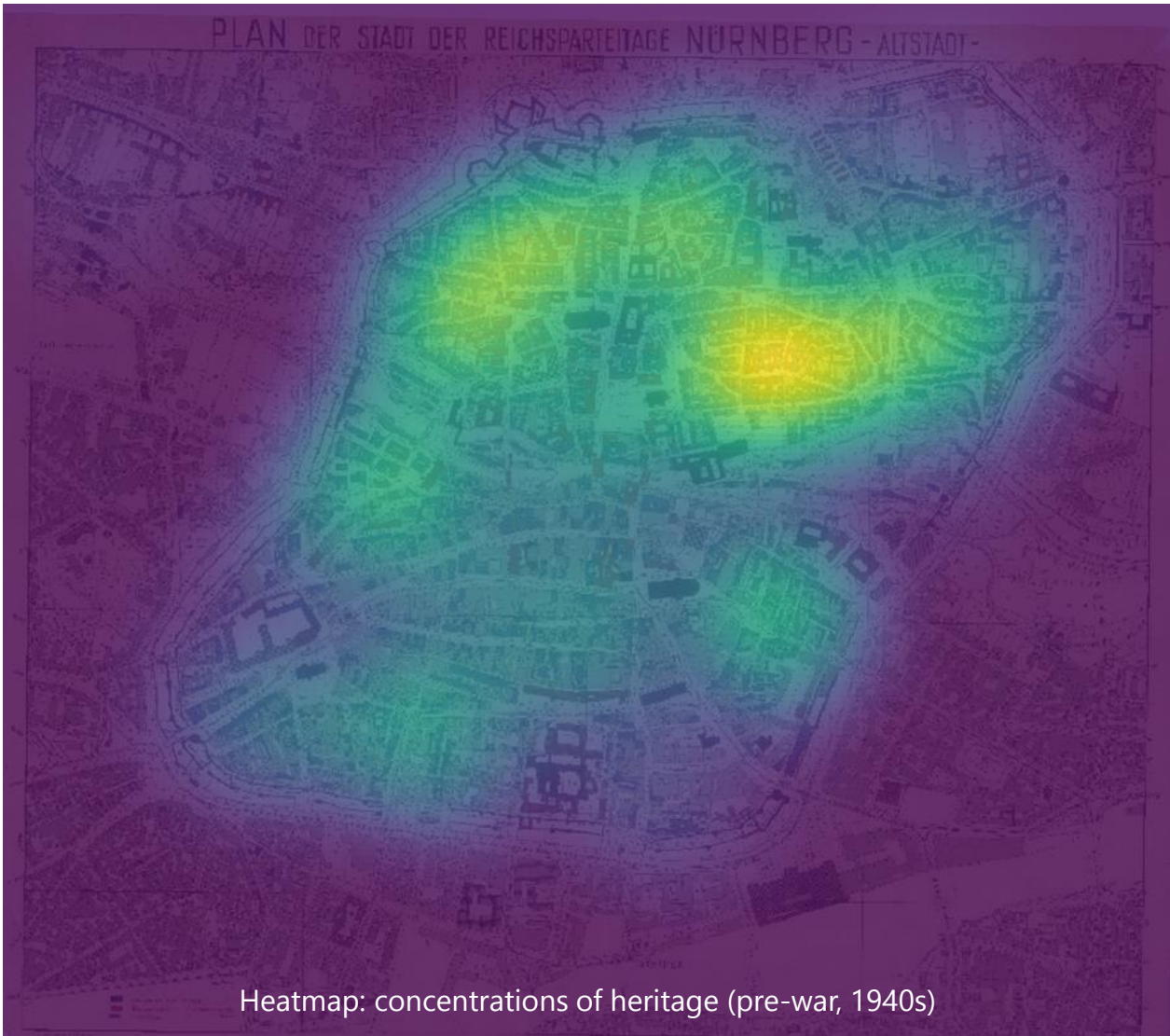


2022

Source: Stadtarchiv Nürnberg, A 4/X, 210

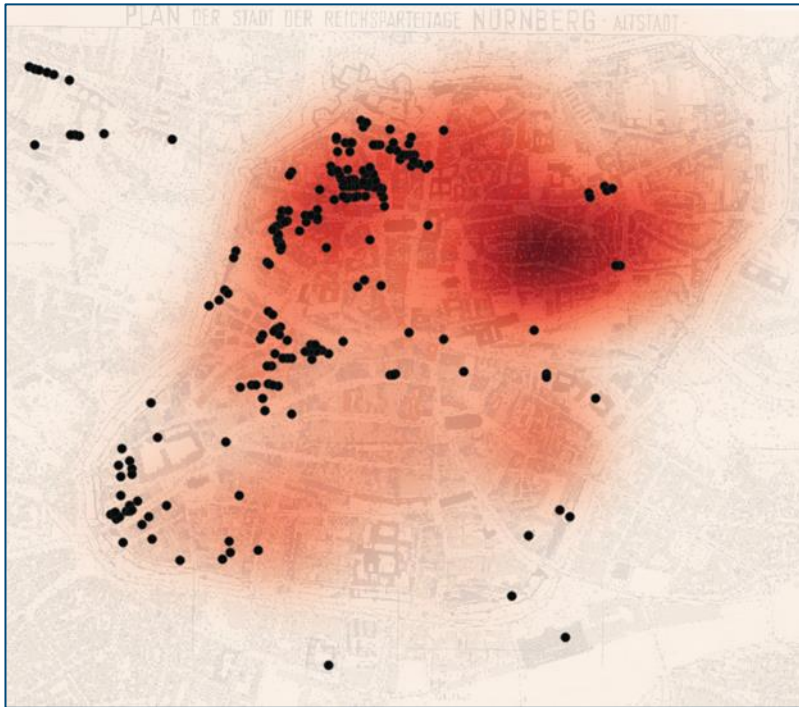
Geodata received from the Bayerisches Landesamt für Denkmalpflege
Significant reduction in historically-valuable buildings today: total number of "Heritage Assets" covering same areal extent as 1940s map: .800 (2052 less)

Visualizing the Spatial Distribution of Heritage

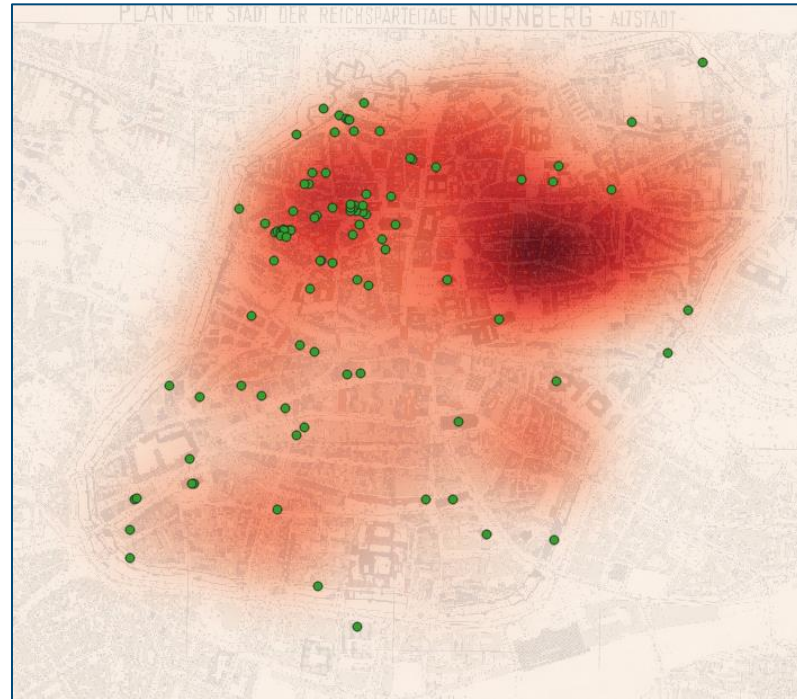


Bomb damage during World War II greatly transformed the heritage fabric of Nuremberg. The spatial distribution of heritage ("hot spots") have shifted from a wider spatial distribution, to a concentration in the North-West/West of the Old Town.

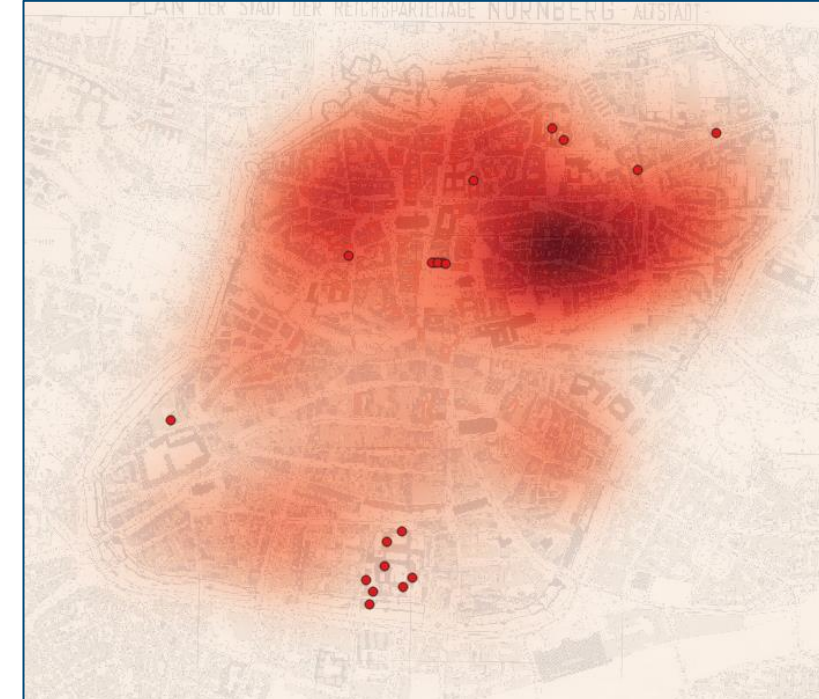
Visualizing the Level of Destruction (4 categories): the Destiny of the 1940s Historical Buildings



Original: unaffected by WW2

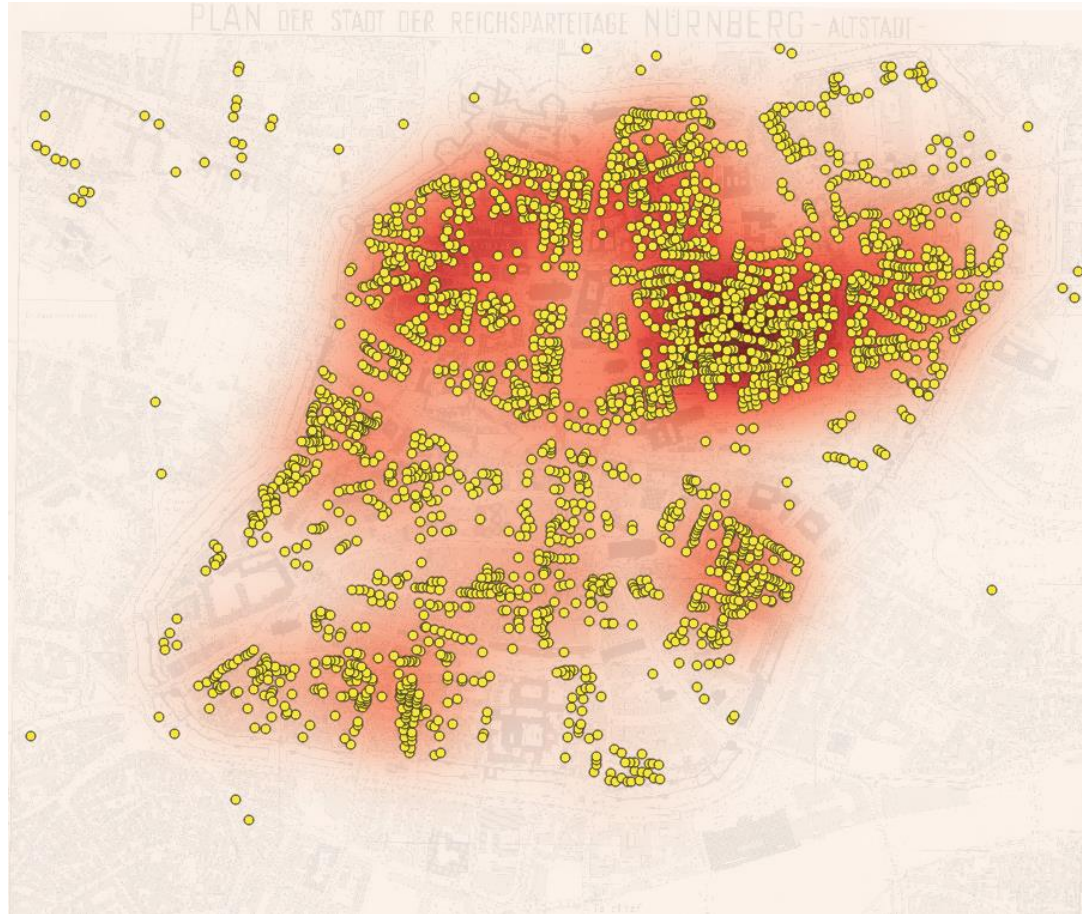


Restored: (fully or in part) to pre-WW2
state

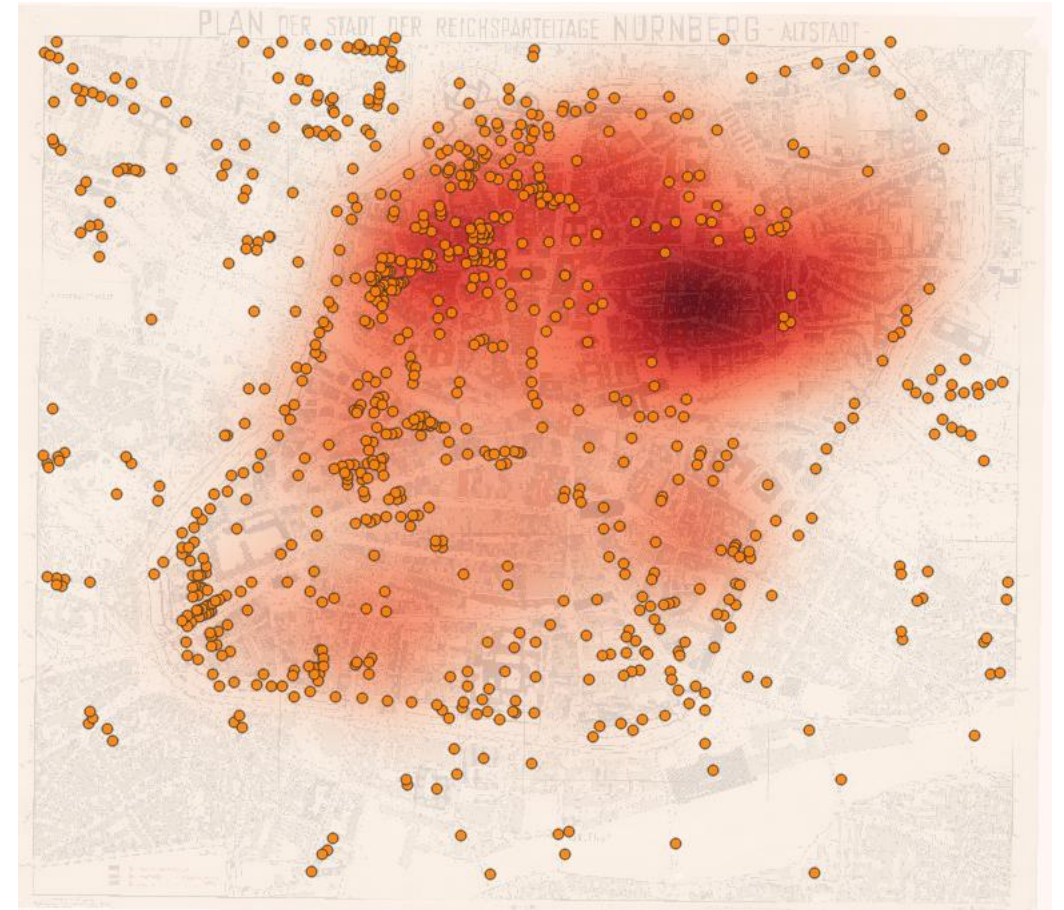


Replaced: new building(s)
erected often in modern style

Visualizing the Lost Heritage and the Present-Day Heritage



Gone: 1940s heritage assets no longer exist



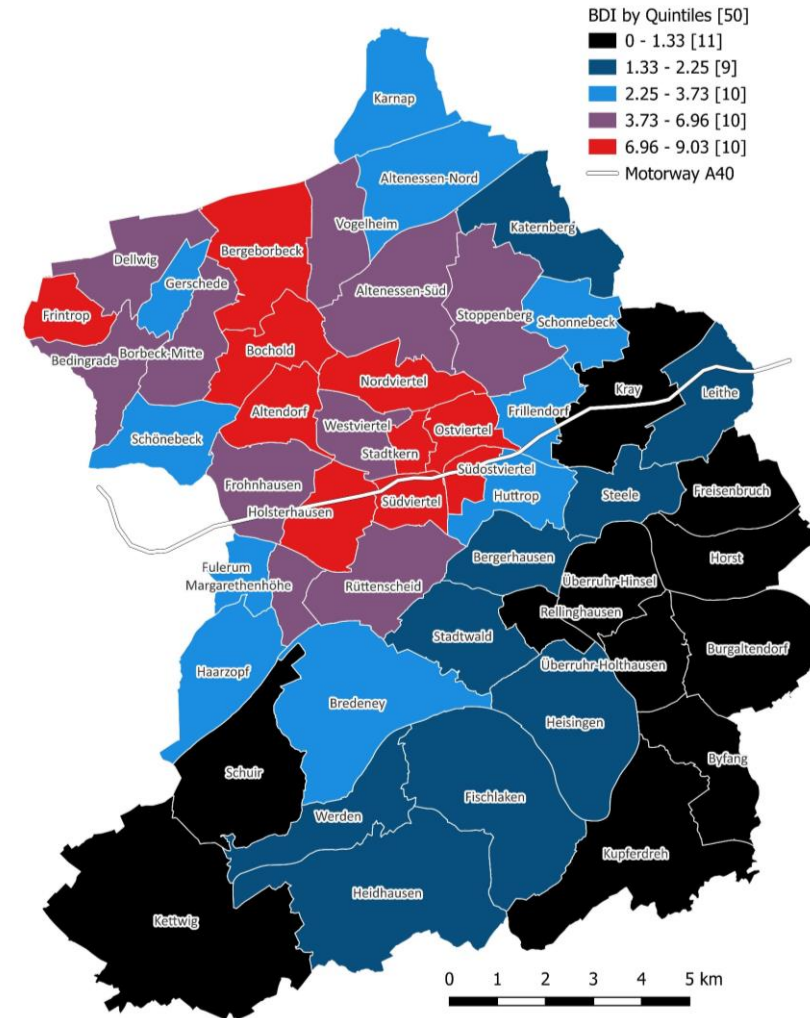
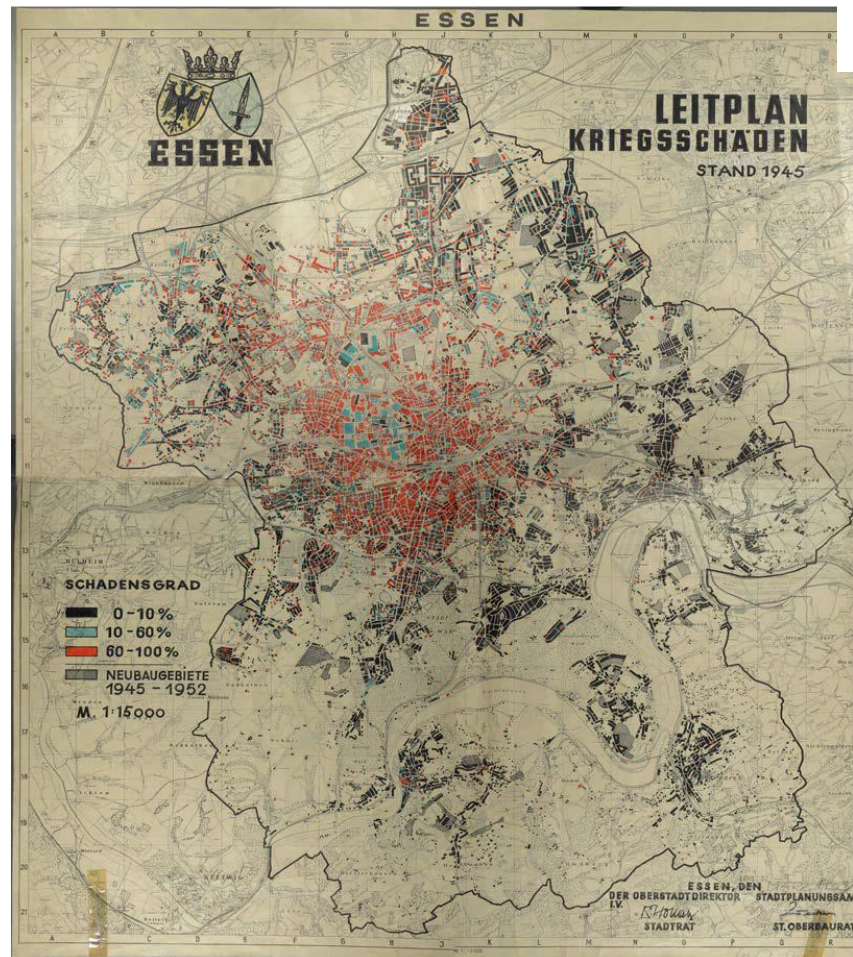
Present-Day Heritage Assets

In many cases, historic buildings were lost and never rebuilt. There are no records of these lost heritage assets.

Social Transformation 4: Socioeconomic Profile



Spatial Distribution of Bomb Damage- Essen (1952)



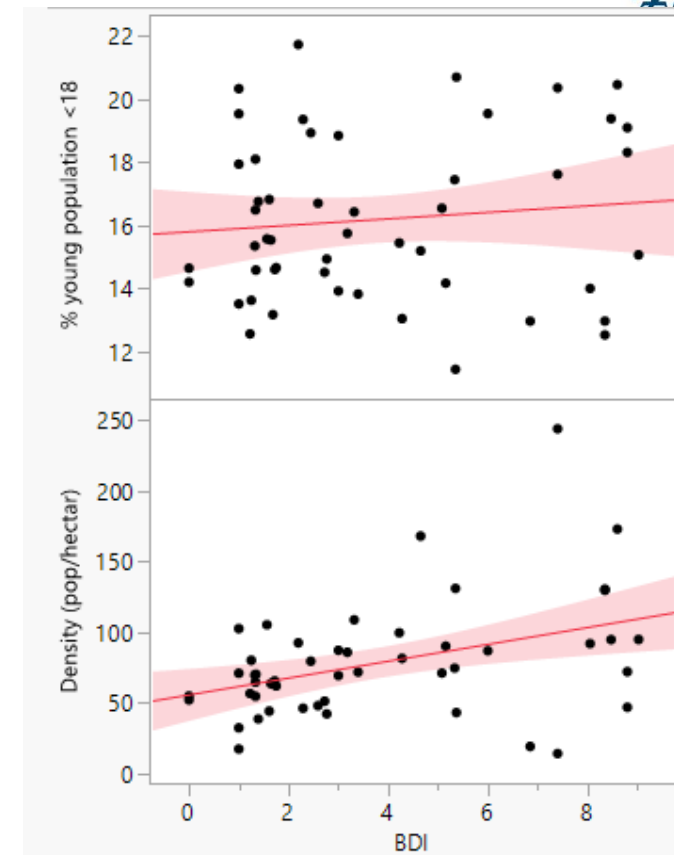
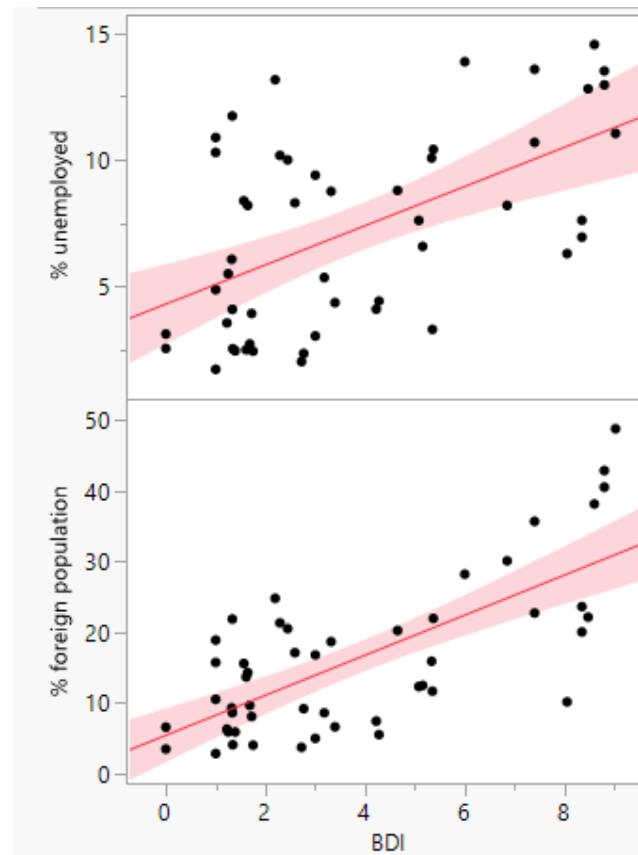
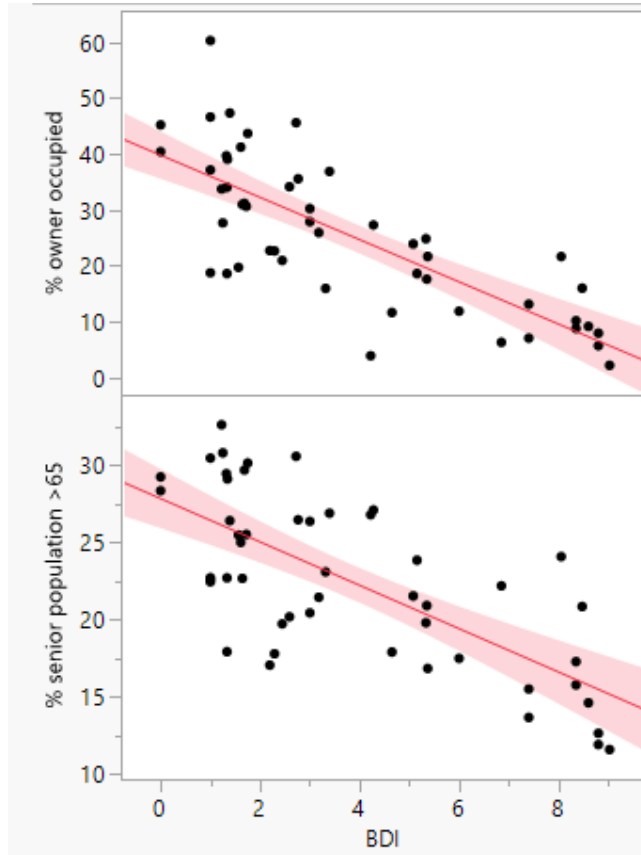
Bomb damage Index (BDI) at the *Stadtteil* level:

Red: highest values of damage;

Purple, Light/Dark Blue medium values;

Black lowest values / no damage.

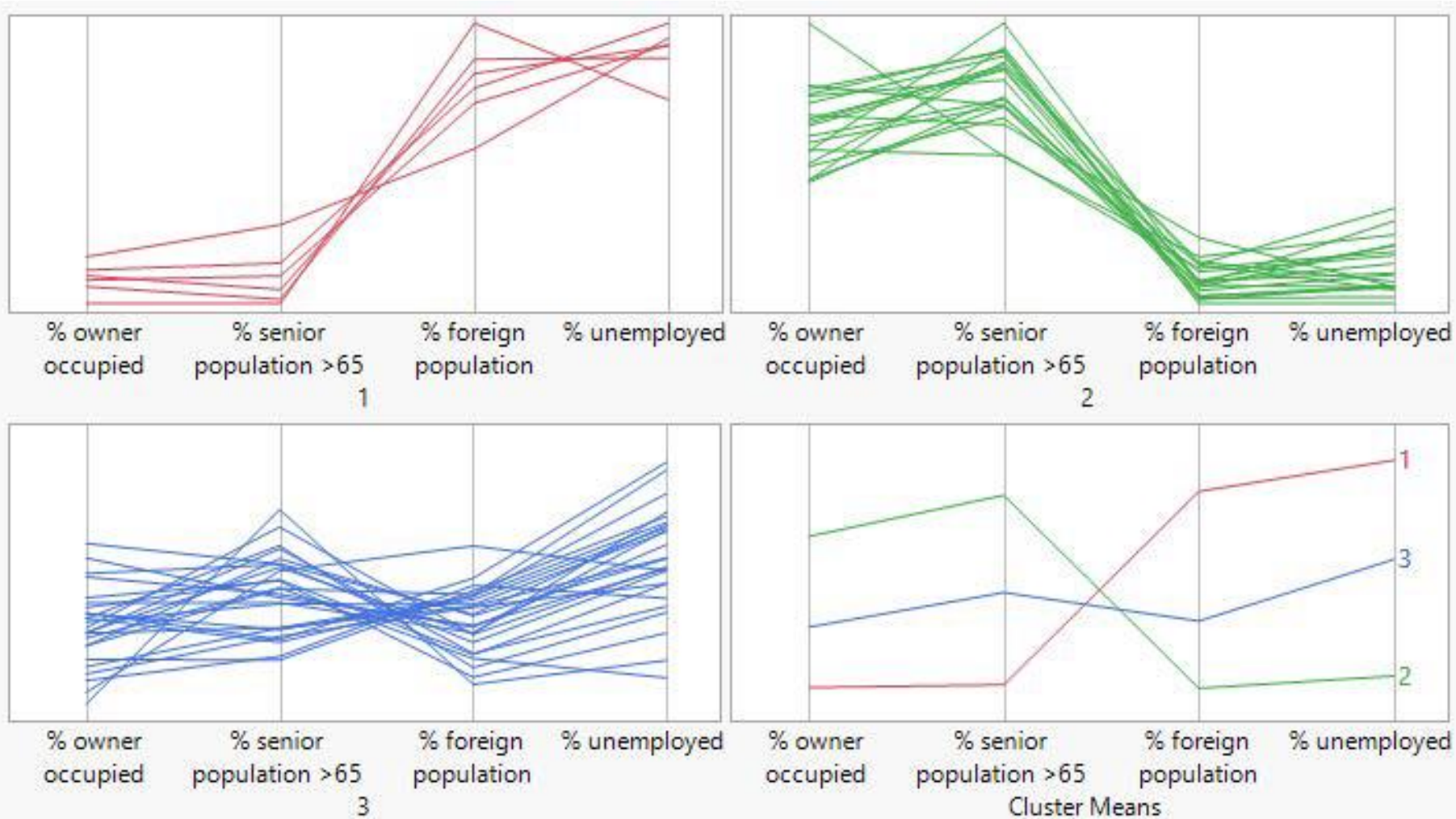
Correlation: socio-economic variables & Bomb Damage Index (BDI)



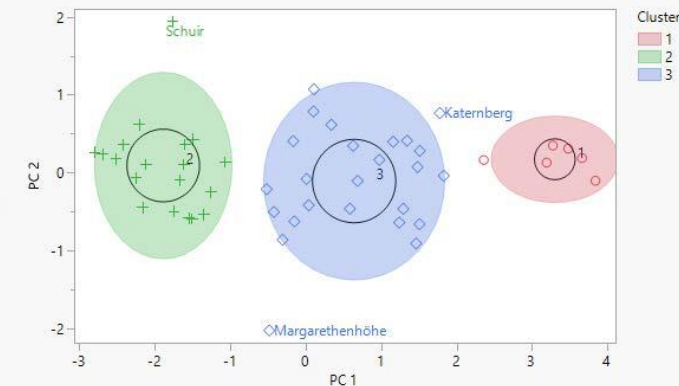
4 strongest correlations

Owner occupied (%)	-0.7717
Senior population >65 years old (%)	-0.7066
Foreign population (%)	+0.7111
Unemployed (%)	+0.5552
Young population <18 years old (%)	+0.1097
Density (pop/hectar)	+0.4022

Cluster analysis of Unemployment, Home ownership, Senior pop, Foreign pop

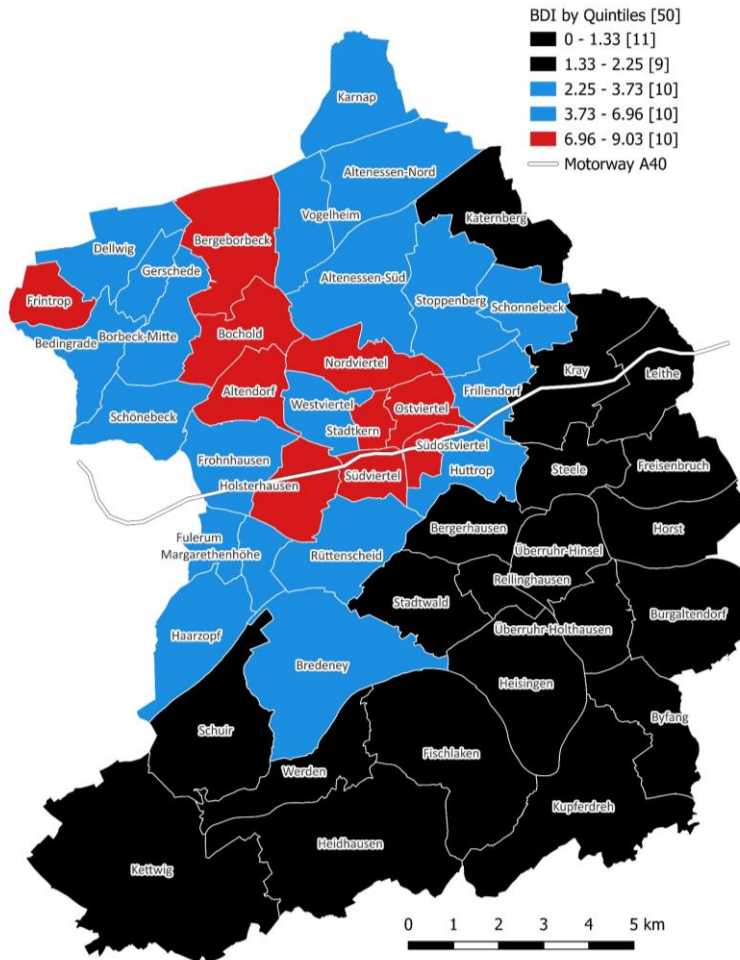
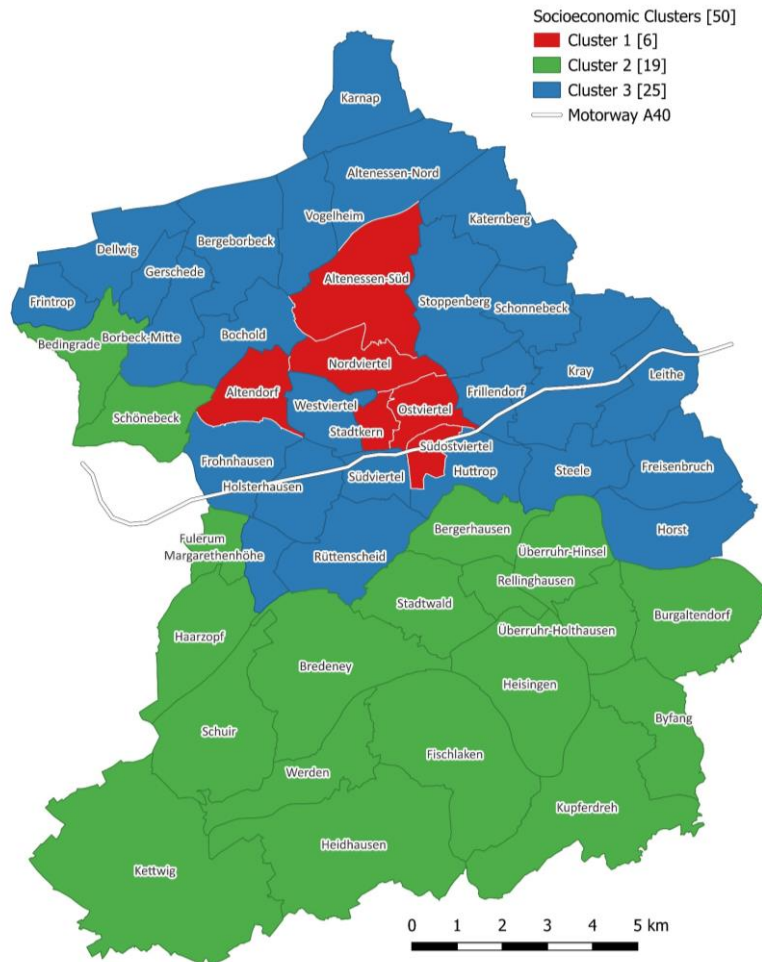


Affluent- middle- less affluent



Socioeconomic Clusters:
Cluster analysis (*k*-means) of
Unemployment,
Home ownership, Senior & Foreign
pop (*k*=3)

Mapping the three clusters of Unemployment, Home ownership, Senior pop, Foreign pop, in relation to Bomb Damage Index (BDI)



Alvanides, S. & Ludwig, C. (2024) The Legacy of Second World War Bomb Damage on the Social Fabric of Essen. TRIALOG, 148/149, 9-18.

Correlations, not causality: Social fabric patterns- 5 of the 6 less affluent districts also heavily bomb damaged. All the heavily damaged districts are either less affluent or mixed. None of the heavily damaged districts can be considered affluent. Post-war planning did not alleviate social disparities across Essen.

Concluding Remarks

Results contribute **methodologically** and **substantively** towards a **new framework for the analysis of postwar cities**, demonstrating how **GIS** can be utilized for historical research and **the study of change in urban environments**.

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