



Redefining Kaunas:

Landscapes of memory for a new identity

CHALMERS



ERIKA LEPESKAITE

Supervisor:

Professor Ana Betancour

Department of Architecture
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2012
Report of Master Thesis

Copyright © ERIKA LEPESKAITE	05
Report of Master Thesis Department of Architecture Chalmers University of Technology SE-412 96 Gothenburg Sweden Telephone +46(0) 31- 772 1000	28
Cover: Vth Fort barracks front facade	42
1. Abstract	05
2. Research	06
2.1 Kaunas city background	28
2.2 Case studies/ Baltic fort route	28
2.3 Kaunas fortress	42
3. Proposal	58
3.1 Actors	68
3.2 Network	72
3.3 Vth Fort	72
4. Design	86
4.1 Fort scale	90
4.2 Building scale	90
4.3 Conclusion	95
5. Bibliography	96

REPORT OF MASTER THESIS

Redefining Kaunas: Landscapes of memory for a new identity

ERIKA LEPESKAITE

Supervisor:

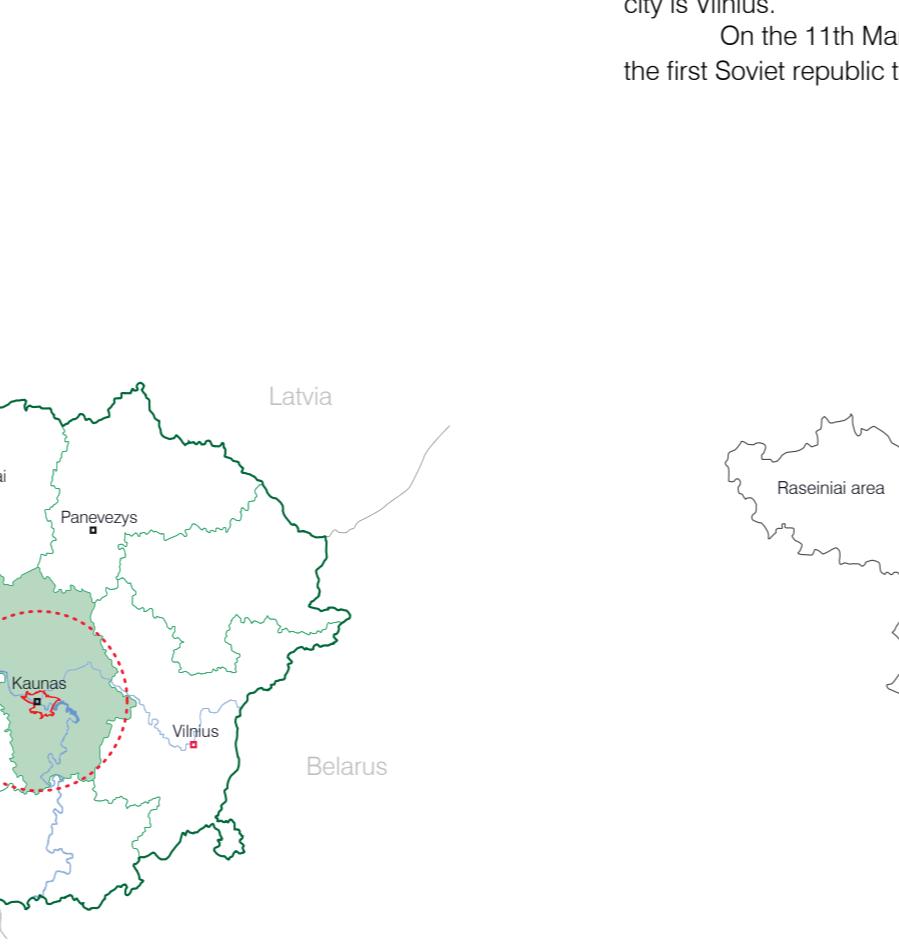
Professor Ana Betancour

Department of Architecture

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2012

2.1 KAUNAS CITY/ BACKGROUND



Lithuania is a country in Northern Europe, the southernmost of the three Baltic states. Situated along the southeastern shore of the Baltic Sea, it shares borders with Latvia to the north, Belarus to the southeast, Poland, and the Russian exclave of Kaliningrad to the southwest. Its capital and largest city is Vilnius.

On the 11th March 1990, Lithuania became the first Soviet republic to declare independence.

Kaunas is the second largest city in Lithuania and a former temporary capital. The city is located at the confluence of the two largest Lithuanian rivers, the Nemunas and the Neris. All Lithuania is devided into 10 districts.

Kaunas city district is rather big and devided into the regions, however actual Kaunas city looks small.



KAUNAS SIGNIFICANCE



Nationalities in Vilnius



Nationalities in Kaunas



Nationalities in Vilnius



Nationalities in Panevezys



Nationalities in Siauliai



Latvia



HISTORICAL GROWTH OF KAUNAS

A settlement was established in the X century, at the confluence of two largest rivers in Lithuania. The City status was given in 1408 and starts to grow fast after Hanza pact in 1441, which created a link to western economies. All the development was happening in the area which is now oldtown, with a very organic radial urban pattern. The development stopped by the end of the 17th century, after it was occupied by the Russians.



Aleksotas suburb



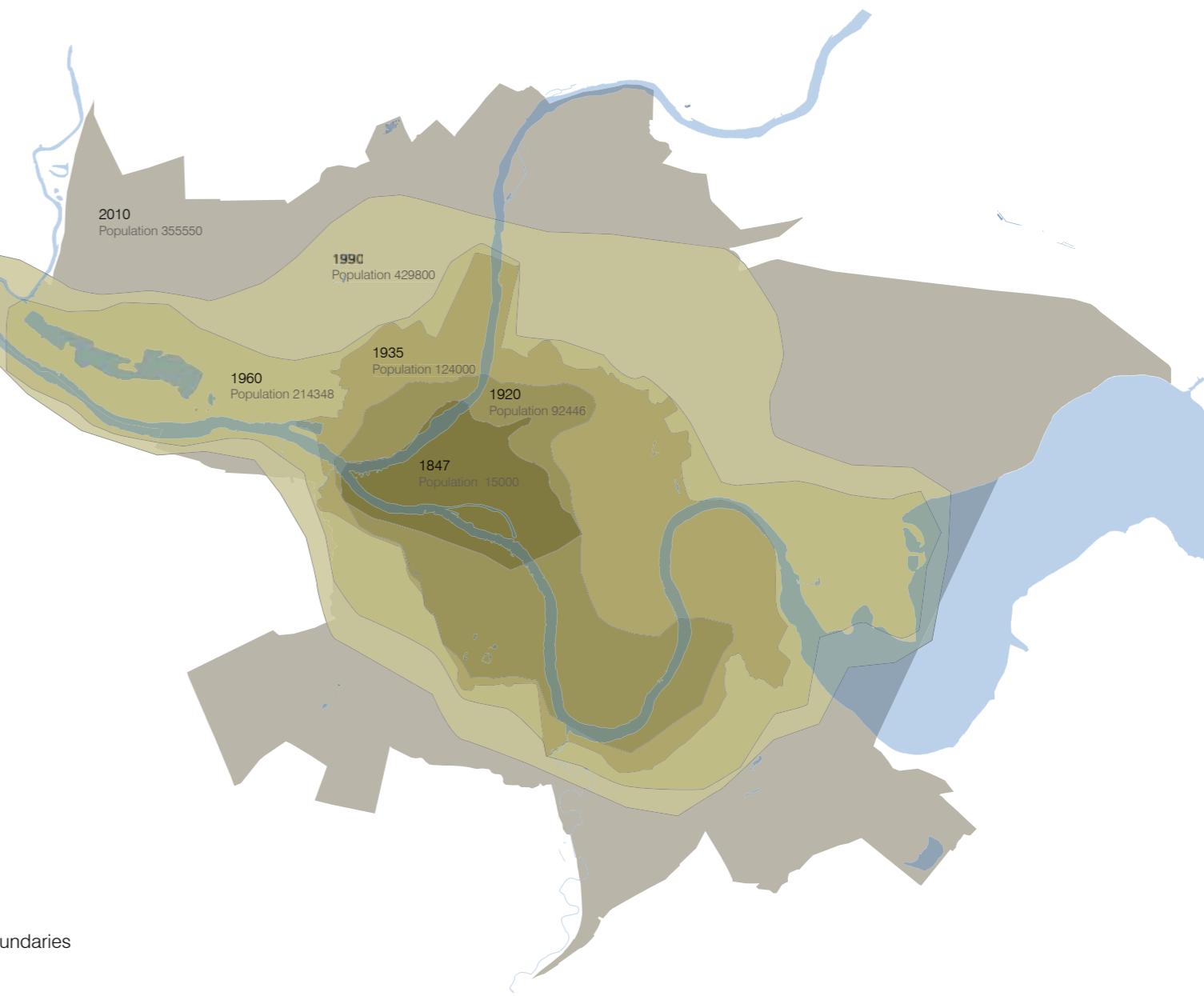
Nemunas river embankment



Nemunas river dock

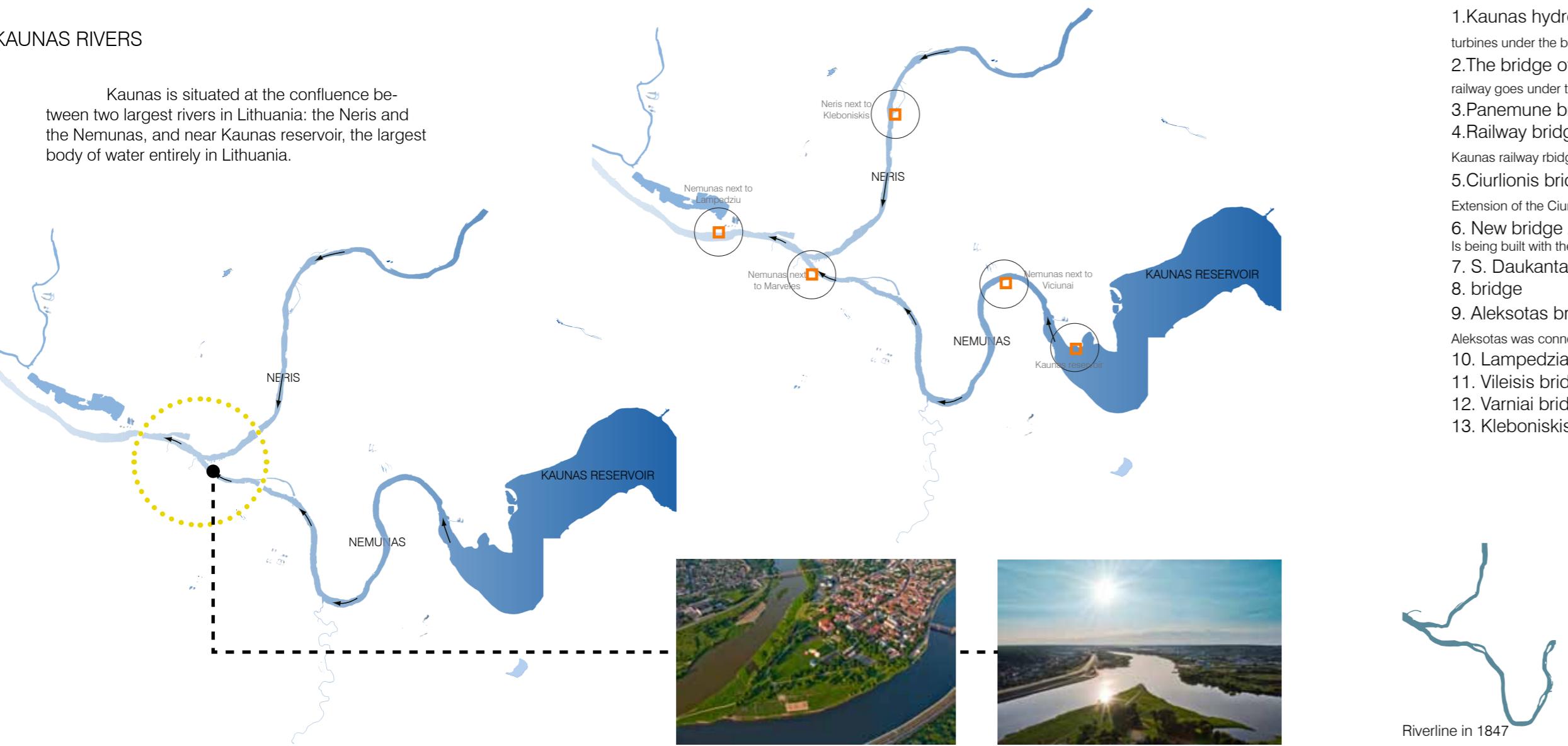
In 1847 new areas were developed, East of the oldtown. It was called New town, the urban pattern was a strict grid of 250x160m blocks. Surrounding developments started to be incorporated into the city and the city expanded. During the interwar period Kaunas was the capital of the country.

After World War II, when Kaunas was occupied by Russia, it turned into an enclosed industrial city. During the period of Soviet Union many people came to Kaunas. The urban population in the final years of regime was around 430.000 people. Since then the number was decreasing and in 2010 it reaches only 355.550 residents.



KAUNAS RIVERS

Kaunas is situated at the confluence between two largest rivers in Lithuania: the Neris and the Nemunas, and near Kaunas reservoir, the largest body of water entirely in Lithuania.



12

1.Kaunas hydroelectric bridge 1961

turbines under the bridge produces electricity energy.

2.The bridge of three girls 1976

railway goes under the bridge

3.Panemune bridge 1957

4.Railway bridge 1862

Kaunas railway bridge was built together with railway tunnel, while connecting St. Petersburg and Warsaw.

5.Ciurlionis bridge 2002

Extension of the Ciurlionis street, was planned to be finished in 1996.

6. New bridge 2010

Is being built with the connection to the arena building in the island.

7. S. Daukantas footbridge

8. bridge

9. Aleksotas bridge 1930

Aleksotas was connected with the old town with several bridges, which were wooden and temporary.

10. Lapedziai bridge 1997

11. Vileisis bridge 1960

12. Varniai bridge 1983

13. Kleboniskis bridge 1981

Riverline in 1847

Riverline in 1920

Riverline in 1935

Riverline in 2010

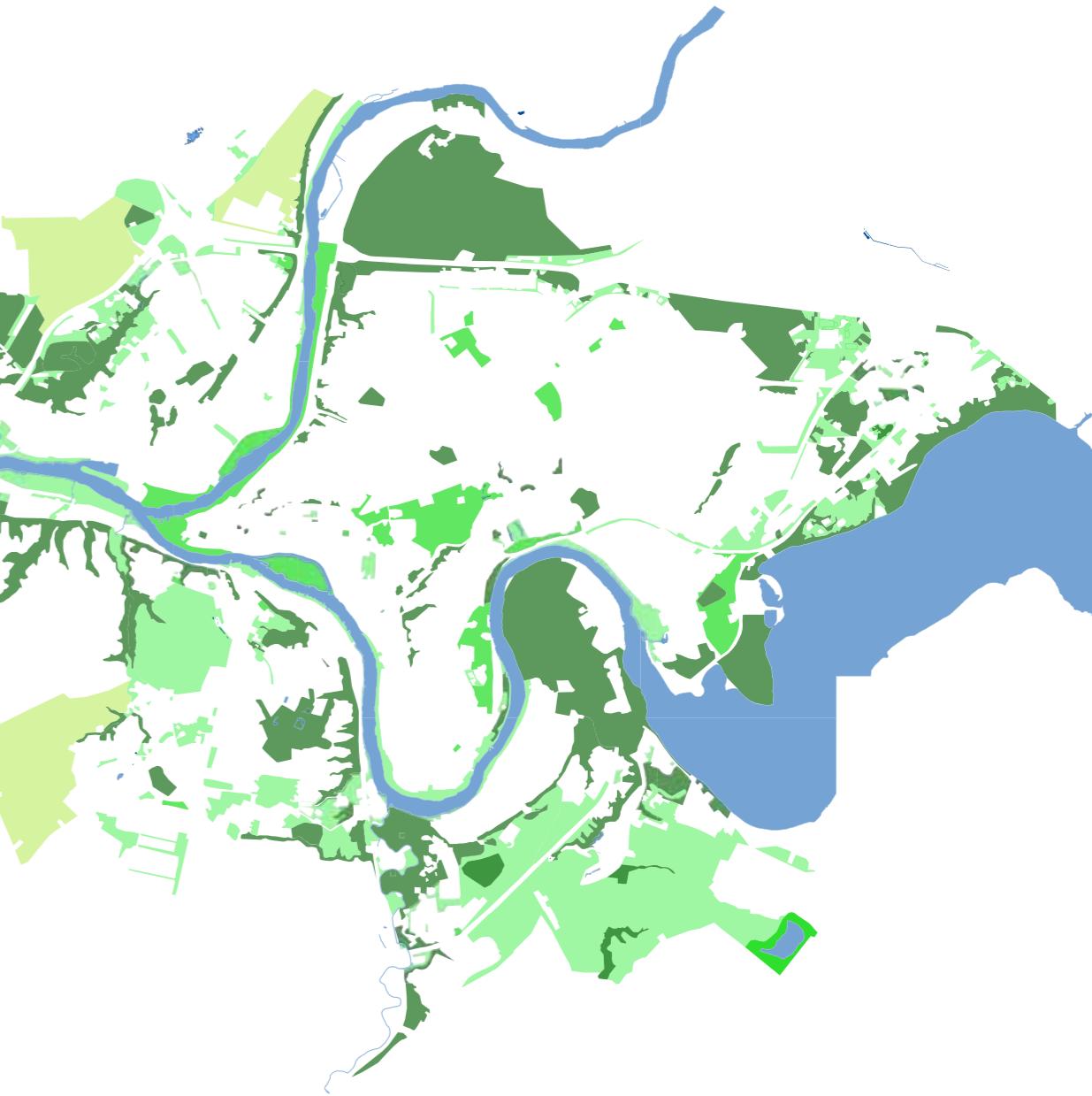
13

KAUNAS GREEN GRID

Kaunas is a green city. Its green areas, based on 1999 inventory data cover- 10,175.662 hectares (64,75% in urban areas).

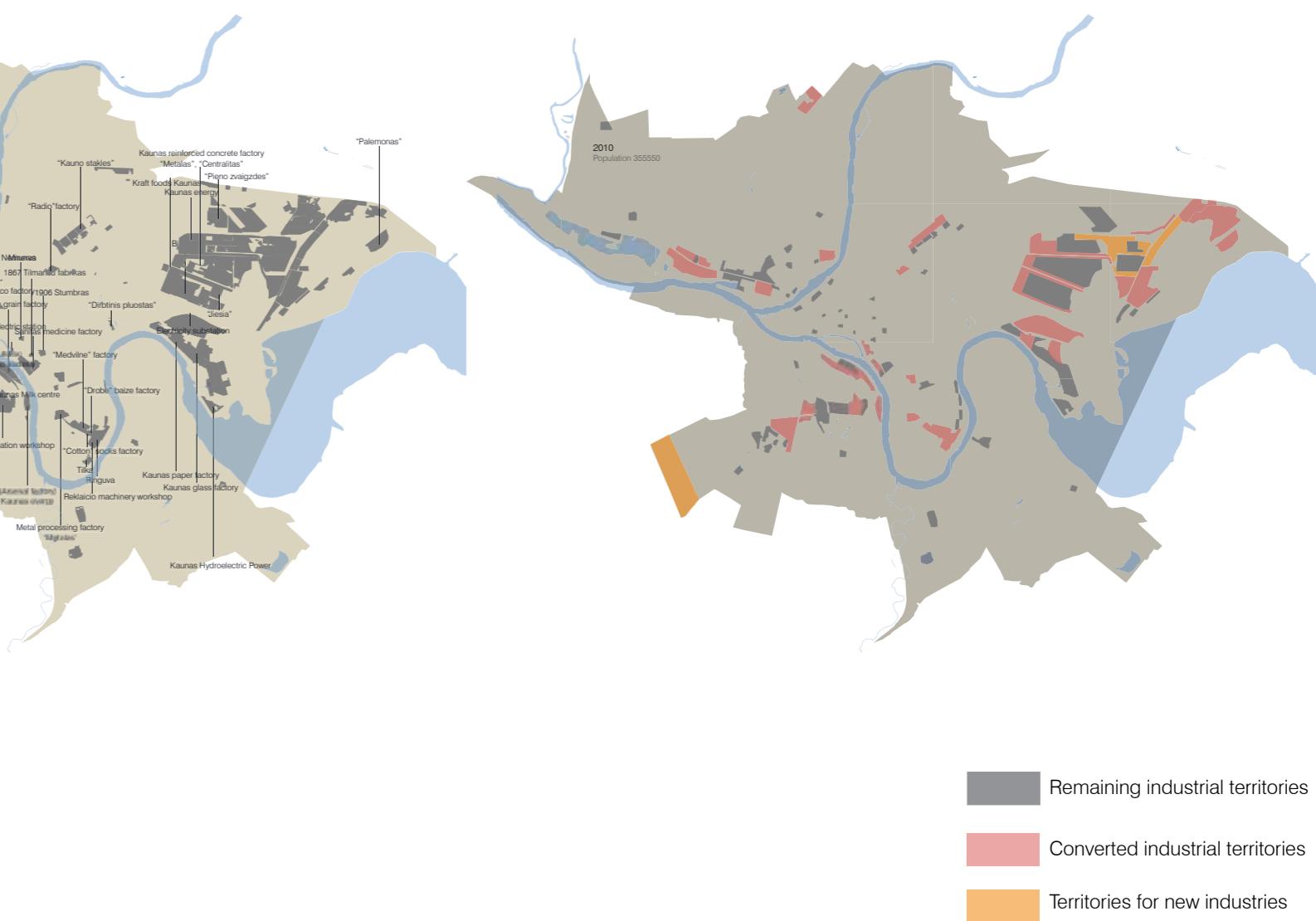


- Agricultural land
- Other open green spaces
- City parks and squares
- Forestry land



INDUSTRIAL DECLINE

After Lithuania became independent in 1990, borders with Russia were closed, causing deindustrialization.



INFRASTRUCTURE

Since Kaunas is located at the confluence of two rivers, there were 34 bridges and viaducts built in the city at the end of 2007. Kaunas is served by a number of major motorways. Kaunas International Airport (KUN) is one of the biggest airports in the Baltic states. It is an important railway hub in Lithuania. The First railway connection passing through Kaunas was constructed in 1859-1961 and opened in 1962.



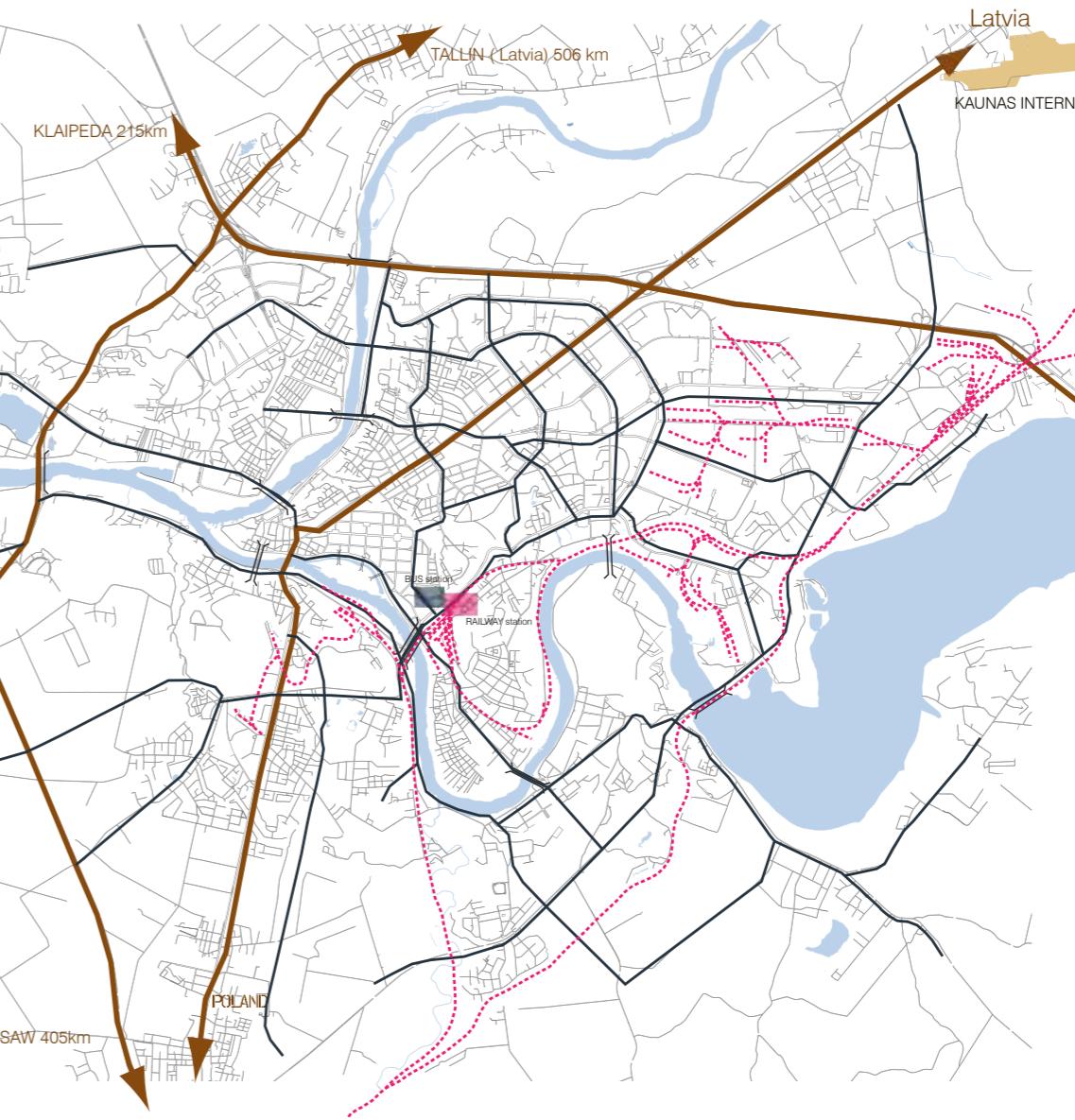
Railway tunnel



Railway station after explosion in 1944

It consisted of Kaunas Railway Tunnel and the Railway bridge across the Nemunas river. Kaunas Railway Station is an important hub serving direct passenger connections to Vilnius and Warsaw as well as being a transit point of European corridors I and IX. Kaunas has well developed public transportation system. There are 16 trolleybus routes, 49 bus routes, a wide shared taxi carrier network.

Having a strong central location in the city helps to create a fairly active hub, with many destination and good public transportation connections. However, other parts of the city are quite monofunctional and creates a necessity to travel around daily. The well organised public transportation does not serve the majority of the residents, since there is a quite high level of car dependents.

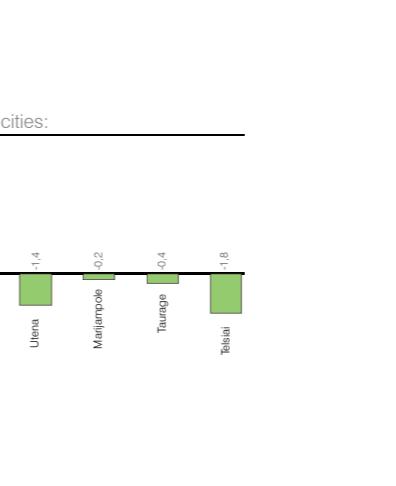
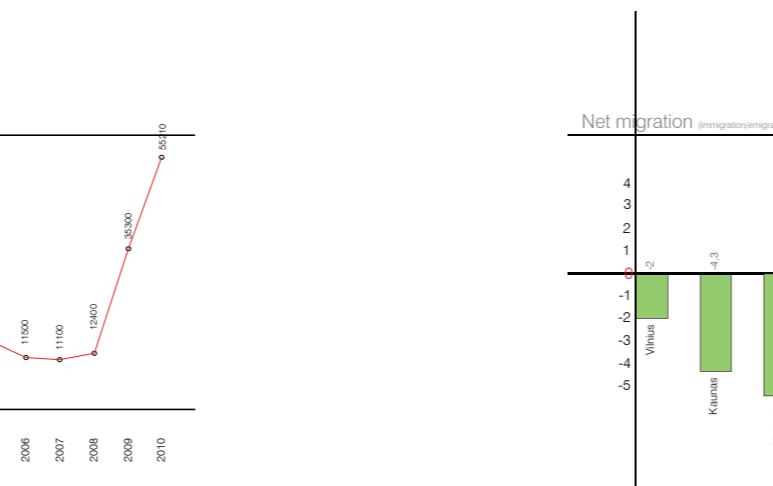


ECONOMY

Kaunas is a large center of industry, trade and services in Lithuania. The most developed industries are: food and beverage industry, textile and light industry, chemical industry, publishing and processing, pharmaceuticals, metal industry, wood processing and furniture industry. Information technology and electronics have become an important area of business activities in Kaunas.



Kaunas Hydroelectric Power Plant is the largest one in Lithuania. The construction of a new landmark, the Zalgiris Arena began in the autumn of 2008 and is due to be completed by December 2010.



International migration by administrative territory, statistical indicator and year

	2003	2004	2005	2006	2007	2008	2009
REPUBLIC OF LITHUANIA							
Emigrants	11 032	15 165	15 571	12 602	13 853	17 015	21 970
Emigrants per 1000 population	3.2	4.4	4.6	3.7	4.1	5.1	6.6
Immigrants	4 728	5 553	6 789	7 745	8 609	9 297	6 487
Immigrants per 1000 population	1.4	1.6	2.0	2.3	2.6	2.8	1.9
Net migration	-6 304	-9 612	-8 782	-4 857	-5 244	-7 718	-15 483
Net migration per 1000 population	-1.8	-2.8	-2.6	-1.4	-1.5	-2.3	-4.7



One of the features of the evolution of modern society is highly migratory population increased mobility, especially to post-communist countries, including Lithuania. As in many central and Eastern European countries, Lithuania, within the political, social and economic changes, had a strong impact on the international migration process.

By the 1990's observed a steady increase of population due to migration from the former Soviet Union (an average of 6-8 thousands people per year) by a mass emigration in the past decade, sought to an average of 20-25 thousand people each year. More than half a million migrated out of the country in the last 20 years. The country is "shrinking", so are most of the cities.

SHRINKING CITY

A "Shrinking" city
In many parts of the world urbanization is happening very rapidly, some cities are continuing to attract residents, while others are losing residents at varying rates. Saskia Sassen's "Global cities" theory forecasts these urban "winners" and "losers": The "winners" are being those cities with agglomerated financial and specialized services. The "losers" being those with outdated industrial infrastructure and manufacture economies.

City of Kaunas has reduced its density, yet grows out into surrounding areas despite the decline of urban substance. "Shrinking" cities can be characterized by older populations, because it is usually the young who leave.

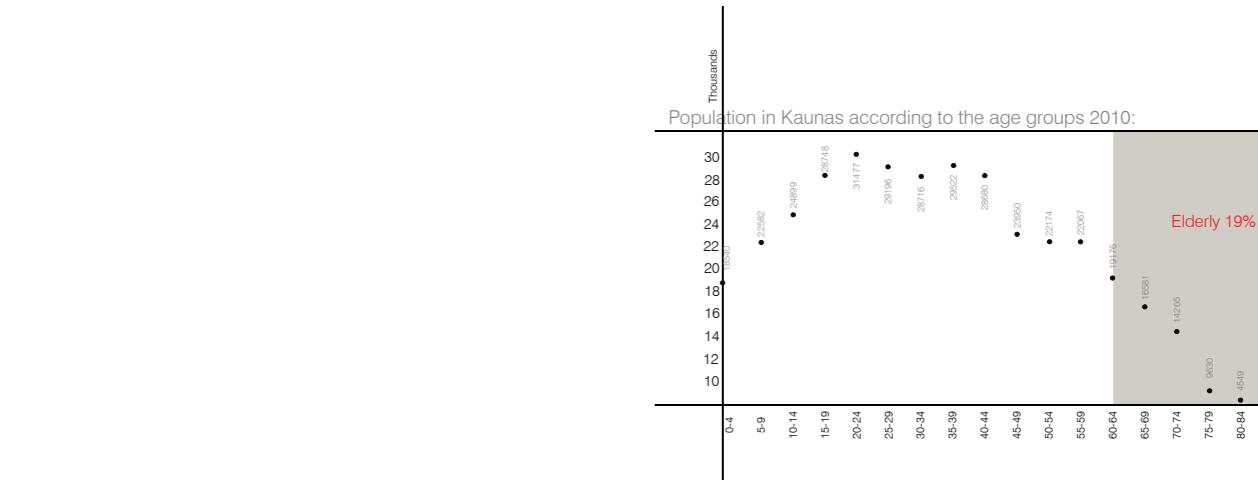
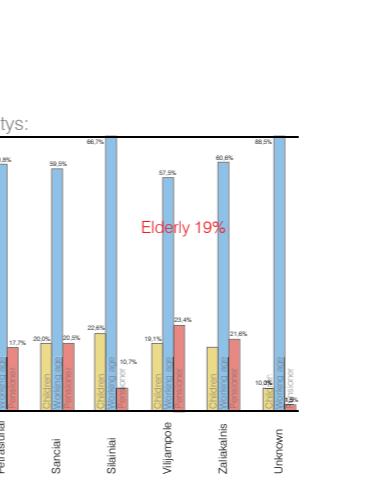
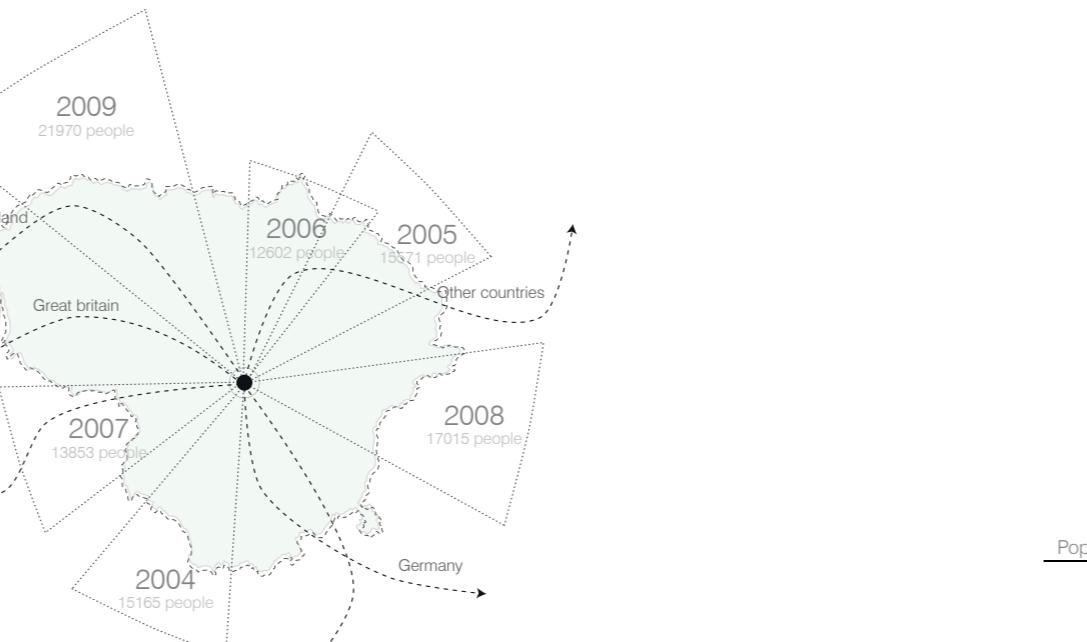
REF [A]



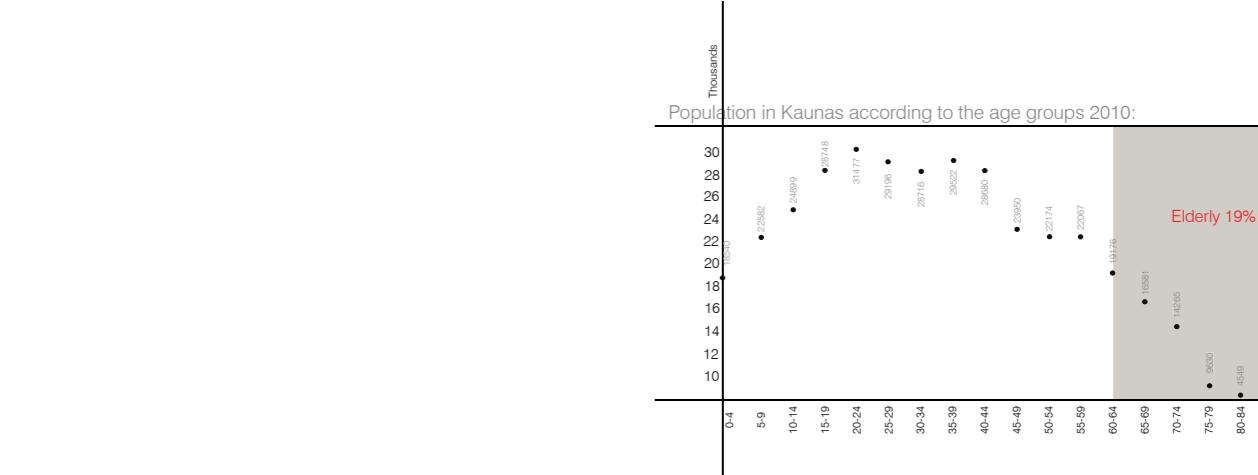
SHRINKING CITIES

Detroit, Hakodate, Ivanovo, Manchester/ Liverpool, Halle/Leipzig.

De-industrialization, migration, suburbanization.



Elderly 19%



Elderly 19%

RUSSIAN EMPIRE , DEFENCE LINE

In my research I became interested in some historical points around the city edge, a unique military architectural heritage built at the turn of XIX-XX centuries, and Kaunas circular fortress.

In the 1879 Russian emperor decided to convert Kaunas into first class military fortress in order to defend the western border of the Russian empire from German invasion. Kaunas was chosen for it's strategical location. Rivers, according to military technologies level, at the time created very good natural defence line.



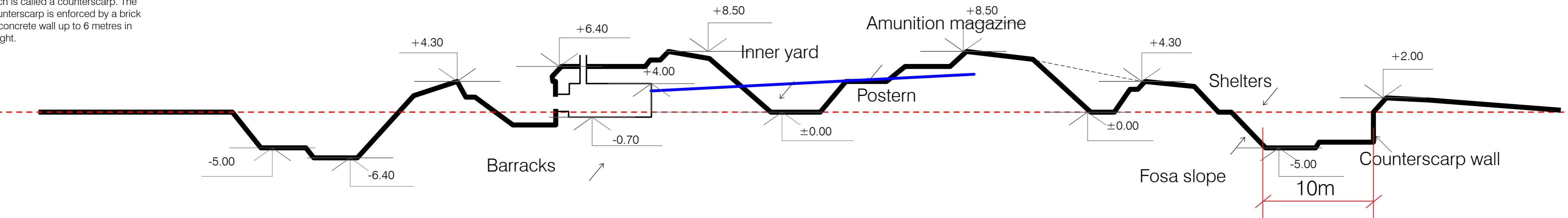
FORT DEFINITION

Fort- is ground surface adoption, for the defence, creating obstacles- hills and slopes, has supporting structures for gunnery and soldiers.

For separate structures to become a fort they should have to be arranged at different heights and such arrangement must not be accidental. First it is necessary to dig a defence ditch or fosse, around the forts pentagon. The outer part of the ditch is called a counterscarp. The counterscarp is enforced by a brick or concrete wall up to 6 metres in height.

All the structures of a fort (barracks, caponiers and semi-caponiers, ammunition magazines and shelters) are casemated, they are designed to withstand a shell hit. That is why the tops of all structures are protected by sand, earth or sometimes even concrete and covered by layers of earth.

All the fortification objects are situated on the rivers and streams slope upper terraces, concerning the review point situated in a very good sites. Although on a very good sites, they are not dominant in the landscape. Artificially built hilly relief embed into the river slopes and green spaces as an important landscape aspects.



TERMS VOCABULARY:

Caponier- the structure, out of which the ditch was monitored and defended.

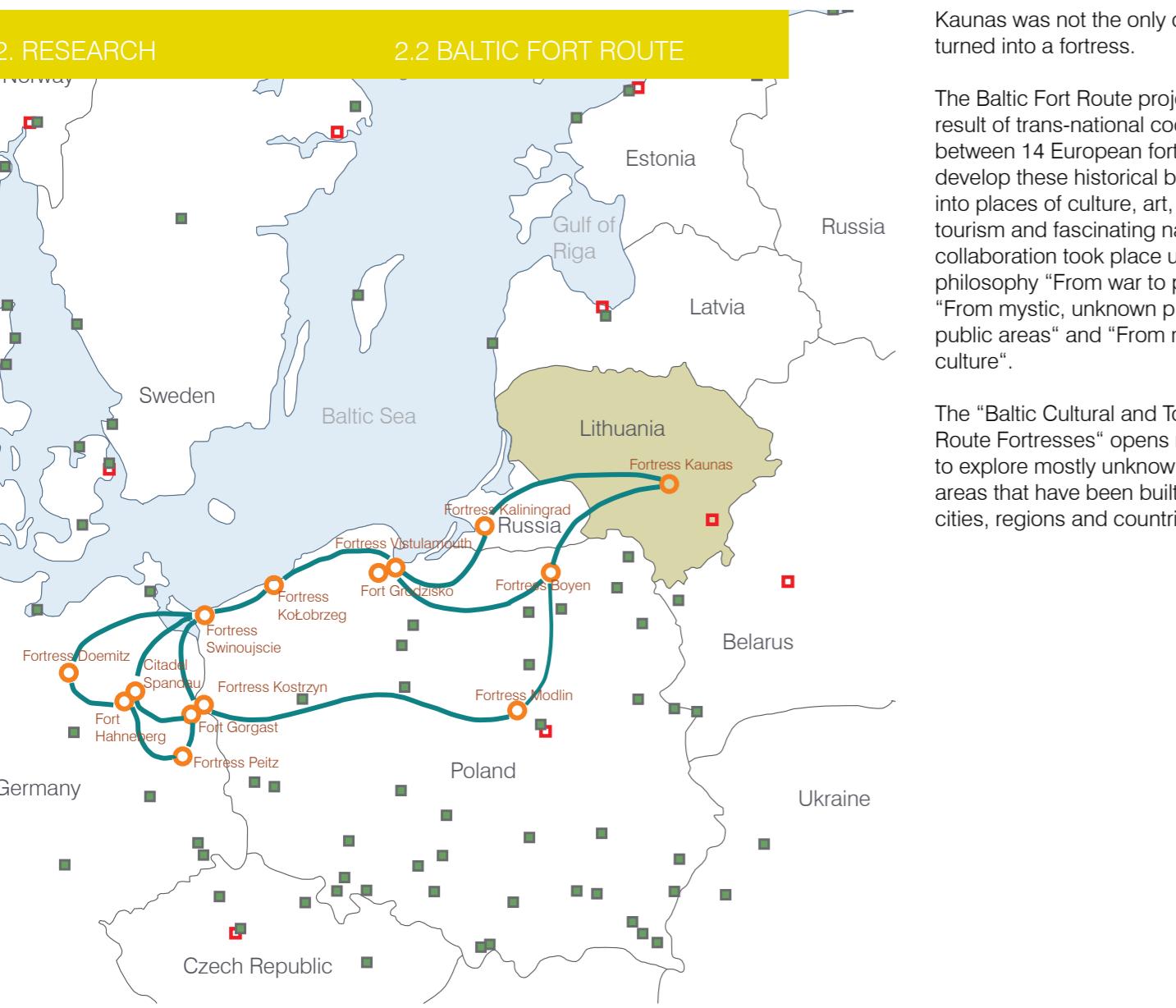
Ammunition magazine- a place to keep the ammunition, gun powder, etc.

Semi caponier- defended just from one side.

Counterscarp wall- a defensive wall, surrounding all the fort territory, built in front of the fosa.

Fosa- a defensive ditch in front of counterscarp wall, dry or filled with water.

Postern- underground gallery.



Kaunas was not the only city that was turned into a fortress.

The Baltic Fort Route project is a result of trans-national cooperation between 14 European fortresses to develop these historical buildings into places of culture, art, leisure, tourism and fascinating nature. The collaboration took place under the philosophy "From war to peace", "From mystic, unknown places to public areas" and "From military to culture".

The "Baltic Cultural and Tourism Route Fortresses" opens new ways to explore mostly unknown secret areas that have been built to protect cities, regions and countries.

Fortress tourism has a high potential. It combines excitement and surprises with cultural entertainment, information, knowledge, leisure and reflection.

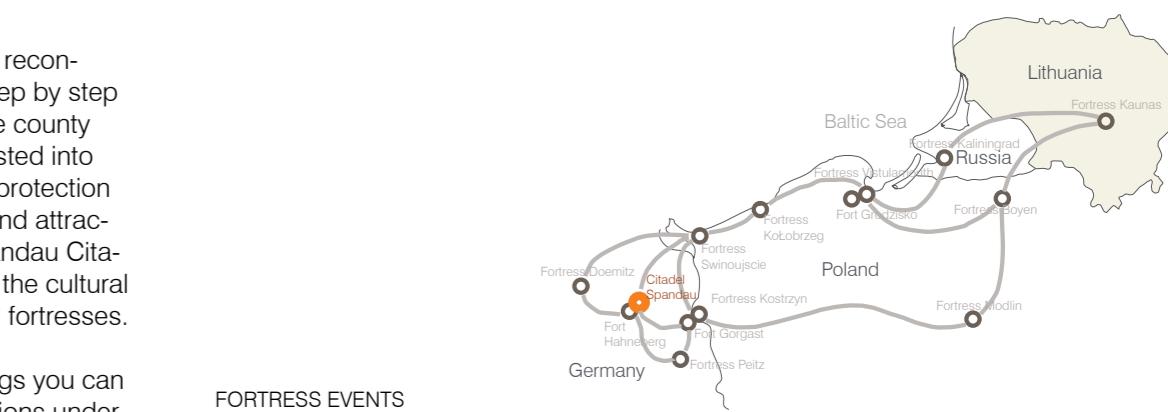
Fourteen fortresses from four Baltic countries took the first step of trans-national cooperation and formed a network. All around the Baltic Sea many more fortresses present pieces of thrilling European history and culture.

Citadel Spandau Berlin, Germany

The fortress was built in the 16th century, but the main tower dates back to the 12th century. It was built to protect the court of the Elector of Brandenburg, the Citadel has seen quite a few different uses, including an ammunitions factory during the Thirty Years' War and a poison gas repository during WW II. The Citadel Spandau offers a rich year-round cultural program, exhibitions, concerts and other activities for all age groups. It is one of the most interesting and most visited cultural centers in Berlin.

Inside the different buildings you can find museums and exhibitions under different themes. Guided tours give extensive information.

On the open-air grounds as well as in the courtyard of the Citadel, there are numerous open air-events.



FORTRESS EVENTS

April	Easter-Knight-Spectacular
May	The Walpurgis Night
September	Castle Festival of Spandau
October	Festival of Bats
December	Days of Citadel Spandau
	The Halloween Party
	Festival of Lights
	New Year's Eve Party



Fort Hahneberg Berlin, Germany

Fort Hahneberg was a part of the defense system of Berlin-Spandau connected with the Spandau Citadel. It was built between 1882 and 1886 to protect the growing city with its young industry. Until 1945 it served the most varied military purposes. After the war, the citizens of the surrounding municipalities used the fort as a quarry to repair their own homes. Because of its position within the inner German boundary, the Fort was situated in the so-called "No man's land" until the reunification in 1989.



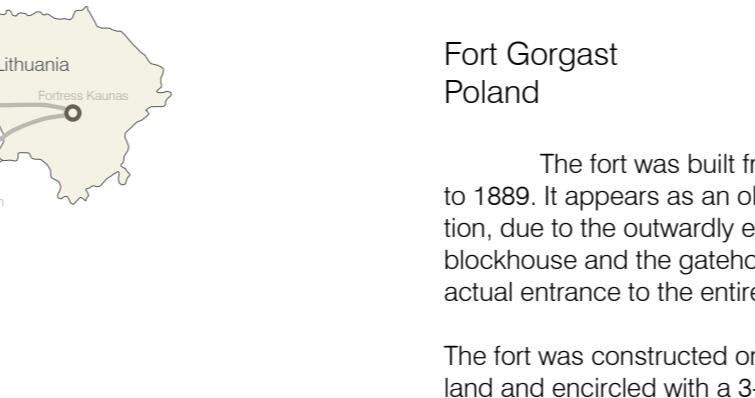
A non-profit association was founded for protecting the fort. It is now in a cross-fire between conservation and nature protection. Due to this, it is partially closed up to the present. The site of Fort Hahneberg is very popular as film scenery, for military festivals and for the education of young construction workers. There are numerous events, festivals and theatre plays in the interesting setting of Fort Hahneberg. It is a great spot for recreation and relaxation at the boundary of Berlin.



FORTRESS EVENTS

March	Easter Festival
August	Hahneberg festival
September	Night of 1000 Lights

September	Fall Festival
-----------	---------------



Fort Gorgast Poland

The fort was built from 1883 to 1889. It appears as an old bastion, due to the outwardly extending blockhouse and the gatehouse, the actual entrance to the entire building.

The fort was constructed on flat farmland and encircled with a 3-meter deep and 42-meter wide moat.

It is the best preserved outer fort of the Fortress Kostrzyn and a place for culture, events, galleries, recreation, leisure time and nature observation.

Following the German reunification, the Gorgast Municipality obtained possession of the fort and, together with the Association Fort Gorgast, takes care of its maintenance and its usage as an historic monument.



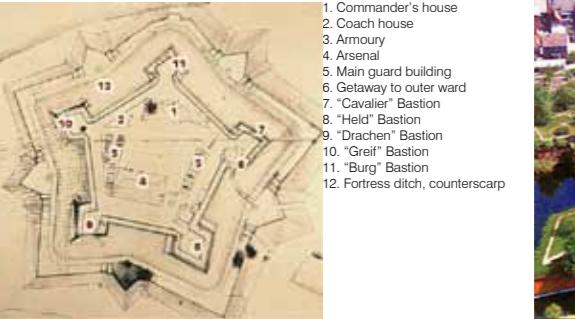
FORTRESS EVENTS

April	The Military Event
May	OBOA The Oderbruch Open Air
	Ship model competition
September	Christmas market
	Trike and Bike parade in the Oder region
	Art exhibitions
	Role Plays
	Choir meetings

Fortress Doemitz Poland

The Doemitz Citadel, located on the bank of the River Elbe in Mecklenburg, is one of the few very well maintained 16th century flatland fortresses of Northern Germany. Arranged in the form of a pentangle, with bastions and vaulted casemates, it is a textbook example of the impressive military architecture of the Renaissance.

The purpose and task of this castle was to secure the south-western border of Mecklenburg, to control the crossings of the River Elbe as well as ensuring the Elbe customs in the harbor of Doemitz. The former military fortress has now become a place of culture.



The site was secured and renovated repeatedly in the following decades. Federal funds were made available for essential repairs and safeguarding work in the 80s under the Future Investment Program.

The fortress was placed under monument protection in 1975 because of the special nature, of its structure and its extraordinary state of preservation. In 1953 a museum for the history of Doemitz' city and region was founded in the fortress rampart.

FORTRESS EVENTS

March	The Art of "Kitsch"
May	The Holiday of the Northern Germany



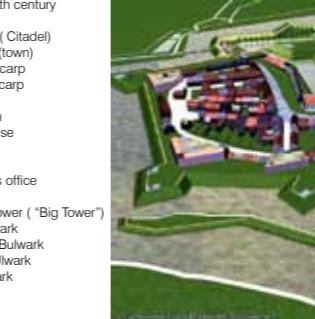
Fortress Peitz Poland

In a sales document from the year 1301, Peitz was first named as "opidum et castum" (city and castle). Not only because of its border situation to Saxonia and Böhmen, Peitz experienced a frequent change of owners. By building the fortress from 1559 to 1562, the possession of the margrave should be protected in a long term.

Over the centuries this building was character determining for the city. Many parts of the fortress were taken down during the expanding of the City of Peitz.

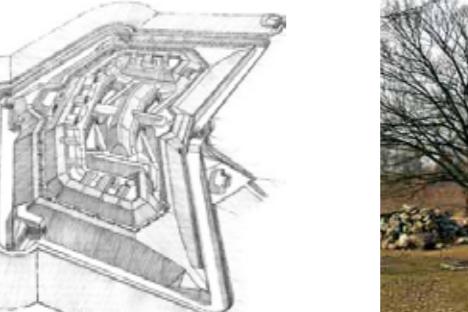
FORTRESS EVENTS

June	Sightseeing - admiring ponds and visiting an opencast mine
June-July	Music Festival by the Pond
September	The long Museums'Night
October	The Carp Day in Peitz



Fortress Kostrzyn Poland

Plans for the reconstruction and restoration of the Old Town and Fortress are successively taking shape. The rubble has been removed from the ruined houses and streets. The Old Town is now a favourite destination and major attraction for tourists. The "Küstriner Festungstage" ("Küstrin Festival") has been held here regularly since the year 2000. Many cultural and open-air activities are offered in the Old Town; concerts and exhibitions of contemporary art are organised in the Philipp Bastion; Artists from all over Europe exhibit at this location. A "Virtual Reconstruction of the Fortress and the Old Town of Kostrzyn nad Odra" still exists.

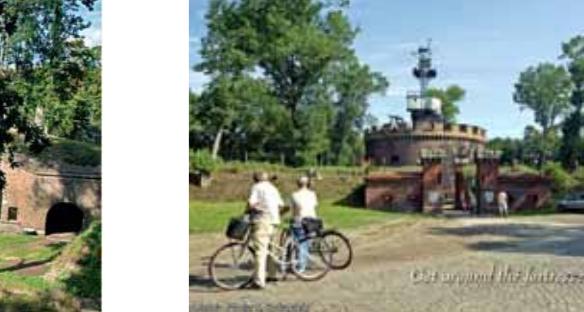


Fortress Kostrzyn Poland

After its completion in 1590, the fortress was one of the greatest works of fortification architecture of contemporary Europe. It was composed of six bastions.

Since 1860 the fortress was given new defensive architecture components in the form of lunettes and guardrooms, which controlled the road, water and newly created railway routes.

The City of Kostrzyn nad Odra supports the introduction of new buildings, forthcoming functions, preservation and maintenance. The forming of a basis for future activities and plans for the rehabilitation of the Old Town area is in process. The inner rooms of the Berlin Gate have been turned into a tourist information centre.



FORTRESS EVENTS

June	City Festival The Kostrinella Festival
August	Station Woodstock "Art at the Border"
August-September	The Kostrzyn Fortress day

Fortress Swinoujscie Poland

Swinoujscie is an island city with international atmosphere that is surrounded by the Baltic Sea in the North, by the Swine River in the East and by the Stettiner Haff in the South. Swinoujscie belongs to the most famous resorts on the Polish Baltic Coast and has a high frequency of international tourists. It is situated in a Seascapes of amazing natural beauty. Of 44 islands only the three islands Uznam/Usedom, Wolin/Wollin and Karsibór/Kaseburg are inhabited. This natural paradise makes Swinoujscie so favorable as a tourist place.

Fortress Swinoujscie consists of a series of new period and modern defensive works, which have survived in good condition.

Gerhard's Fort is the beginning of a four-kilometer educational trail called "the fortification path". It is equipped with resting sites and educational boards.

The path includes some Prussian objects from the First and the Second World War and some "Cold War" objects.

It is possible to order a tour guide for organized groups and to buy some souvenirs connected with the fort and town.

This natural paradise makes Swinoujscie so favorable as a tourist place.

There are also the open-fort-days called the Days of Maritime Fortress, which all kinds of surprises for the tourists.

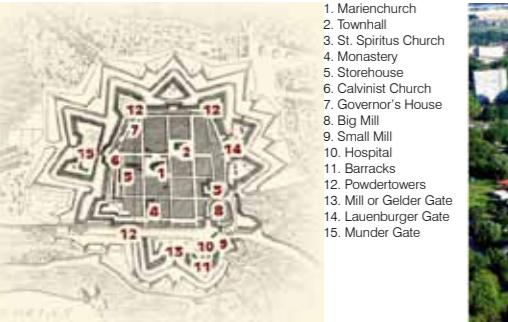


FORTRESS EVENTS

June	Sea Day Days of Navy International Music Festival "Organ Evenings in Swinoujscie"
July	Artistic Festival of Academic Youth – FAMA
August	Regattas
September	International Floating Festival of Marine
October	International Wolgast Marathon Uznam Music Festival

Fortress Kołobrzeg Poland

Built in the 18th century and modernized in the first half of the 19th century, Fort Münde and its lighthouse from 1945 are the symbols of the city. Situated at the delta of the Persante River into the Baltic Sea, it dominates the view from the six kilometer long beaches of the Sea Resort Kołobrzeg. It reminds of the city's former fortress history and its rich moving past.



Today, Kołobrzeg is one of the most famous Sea Resorts in Middle Europe. The city at the Baltic Sea has a very modern infrastructure that connects relaxing nature and high quality beaches with fun activity programs, culture and leisure all surrounded by great historical fortress buildings.

FORTRESS EVENTS

July- August	Pirate Adventures Regatta Summer Night Concerts in the Morast Redoubt
August	The Caribbean Festival



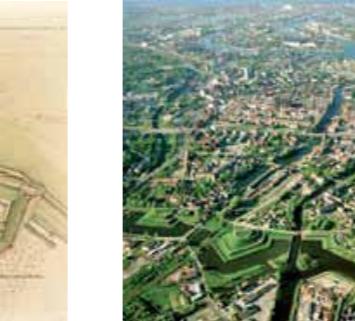
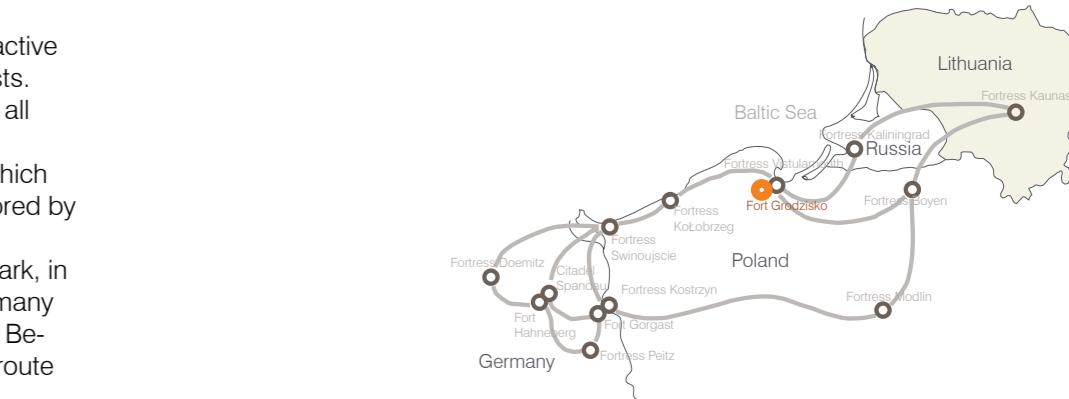
Fort Grodzisko Poland

Grodzisko Fort is located in the very centre of Gdańsk, in the closest distance to the Main Railway Station and Central Bus Depot. It is situated on the Gradowa Hill, which is of more than 40 m height and dominates over the center of Gdańsk. The place was fortified around the 17th century and together with Bishop's Hill - formed the western front of Gdańsk's fortifications. In its present shape the Grodzisko Fort origins from the 2nd half of the 19th century when the great building works were undertaken by the Prussians. It was rebuilt as a polygonal fort.

Today, Grodzisko is a very attractive place for inhabitants and tourists. The area of over 20 ha is open all year around.

FORTRESS EVENTS

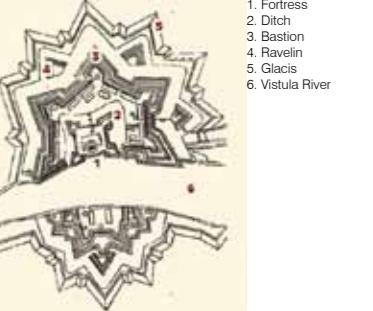
July- August	Historical plays
March, September	Picnic
May	The Knight Tournament
June	The Baltic Festival of Science



Fortress Vistulamouth Poland

Vistula A unique fortification monument – the Wisłoujskie Fortress – is located in the close vicinity of the Westerplatte peninsula. The site had a strategic importance as it gave control over the ships moving into and out of Gdansk's harbor and also into the famous cities along the river like the former Grudziadz, Toruń, Krakow and Warsaw.

The former Port of Gdańsk was situated on the Motława River, a few kilometers away from the coast. This gave Vistulamouth a key position shielding Gdańsk from the sea and protecting the city and the port from a surprise enemy attack. On the fortress tower the view goes from the estuary of the Vistula River at the Baltic Sea far into the country up to Gdańsk. It takes the visitor from the rich-in-history Westerplatte over to the other side of the riverbank and the numerous shipyards that lie along the riverside up to Gdańsk. On sunny afternoons you can see tourist cruise ships going up and down the river.



Fortress Modlin Poland

Modlin is probably the largest in size historical fortress site in Poland today. Napoleon began to expand the fortress to both sides of the River Narev at the estuary into the Vistula to secure his leadership in Eastern Europe. During the 19th century the Russian Czar considerably expanded the fortress again employing Polish construction workers. Here, the architecture of different empires can be seen.

The heart of the major fortress Modlin is the citadel. With its 2.2 km long barrack and the bastioned enceinte, it is almost completely preserved.



Many parts of the fortress and constructions such as walls, ditches, gates, sheds and outer defenses make the citadel an open air museum of a special kind. There are many unknown things that can be explored. The forts, built from 1810 to 1812, were developed into larger, regular works, surrounding the fortress.

Eight brick forts were built from 1870 to 1880 at distances from 2 to 6 kilometers from the citadel. A further girdle of forts was erected from 1912 to 1914 with 10 concrete structures at distances from 5 to 10 kilometers from the citadel, forming a ring of approx. 50 kilometers. The forts serve different functions today and have different owners.

FORTRESS EVENTS

August

The international rally of historical vehicles

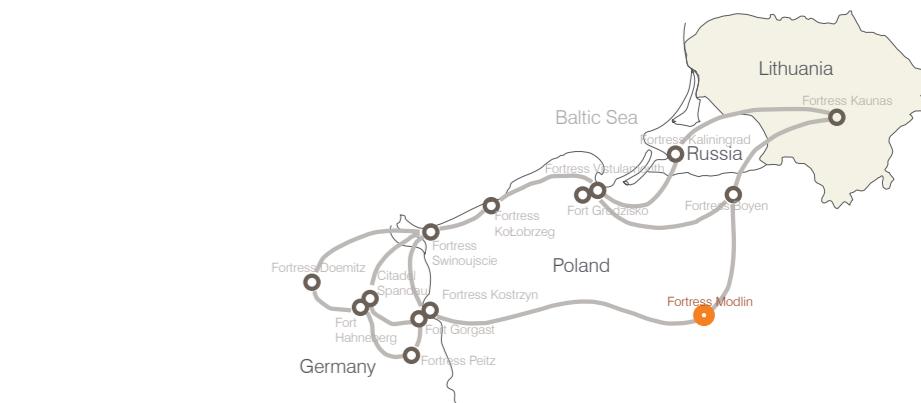
September

Historical performance

All year around

Cabarets

Exhibition of paintings, sculptures, drawings and photographs



Fortress Boyen Poland

The Boyen Fortress was built between 1844 and 1856 and presents an excellent example of Prussian fortification. The Fortress obtained its name after the Prussian general, Hermann von Boyen, who as the first presented the idea of building such military structure in the center of the Great Masurian Lakes region. Today, the great historical Fort Boyen is a place for events, leisure time and relaxation, as well as, an information center for the places history.

The neighboring lakes offer many water sports activities and the landscape invites to extensive tracking tours.



FORTRESS EVENTS

May	The Gizycko Days
July	The Chant Festival
	The Cabaret Night
	The Summer Festival
	St. Brunos Fair
August	The Jazz Festival



Fortress Kaliningrad Russia

The focus of fortification on the German Empires eastern frontier was Fortress Kaliningrad. To secure the border against Russia, the Prussian King Frederic William IV ordered the city to be fortified. The city was circumvallated from 1843 to 1862 in the new Prussian system; the Friedrichsburg Gate was inaugurated in 1862. The circumvallation was finished in 1889/90 with the completion of the Meadow Front between the Pregel and Lithuania Bastions.

Lithuania

Fortress Kaunas

The uniqueness of the Kaliningrad Fortress system comes from the mostly well preserved site, a complete brick stone architecture, the visibility of the fortress structure and of the fronts in the city's ground plan, the massiveness of its walls, the one of a kind gate architecture and the massive rings of the outer forts and intermediate works.

Number of objects of the fortress were restored, others well preserved. The entrance gate to the Friedrichsburg remained in ruins up to modern days. The gate is still used as a traffic gateway. The Friedländer Gate is now a frequently visited museum.

FORTRESS EVENTS

July	The International Knight Festival
Summer	Rock-Bike Festival "Baltic Storm"



FORTRESS EVENTS

July	The International Knight Festival
Summer	Rock-Bike Festival "Baltic Storm"

2. RESEARCH

2.03 KAUNAS FORTRESS

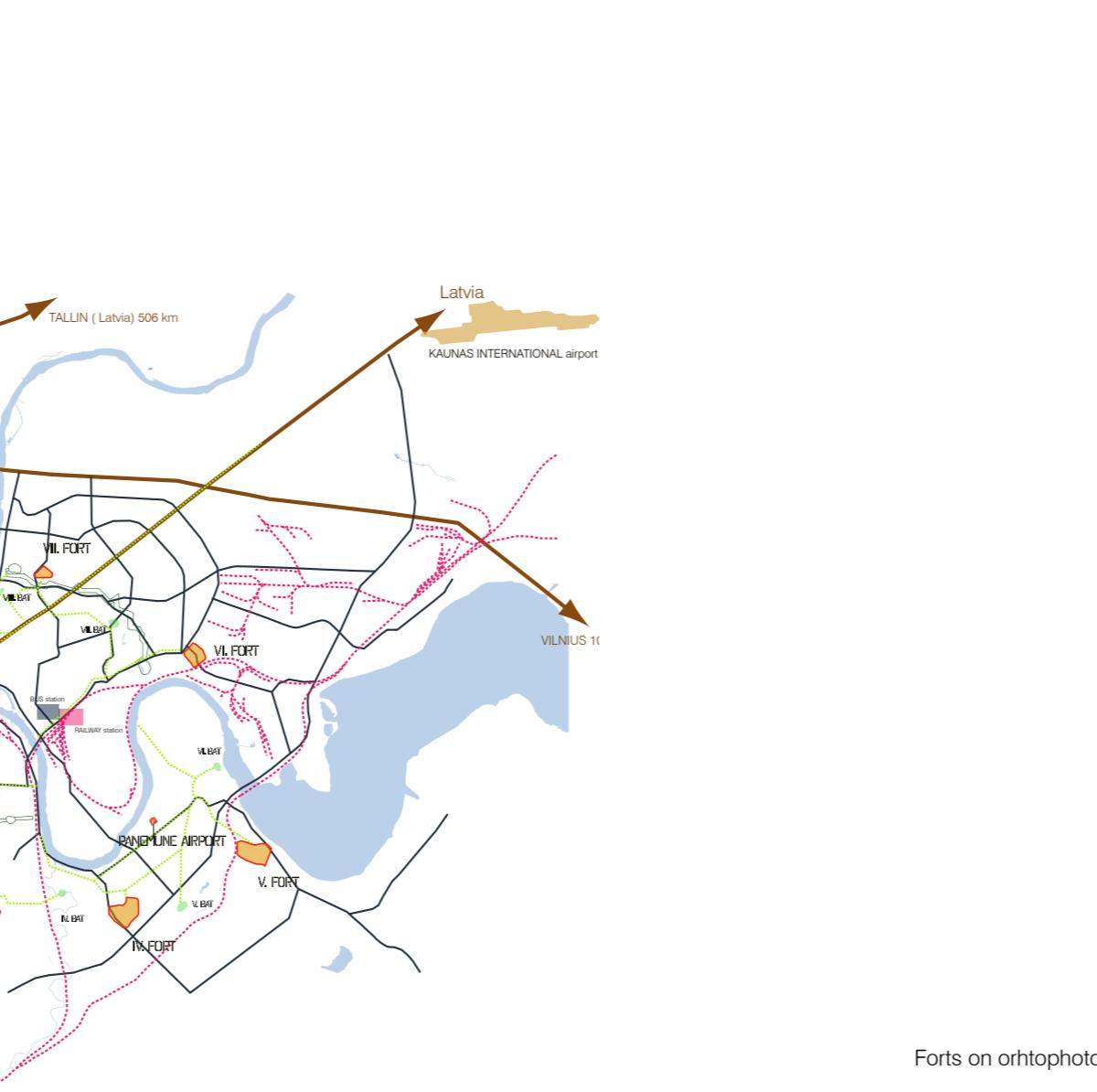
Kaunas circular fortress consists of 9 forts.

Forts were built at the approaches to Kaunas city in distances of 2-2,5km. The line of the set of forts formed almost a regular oval.

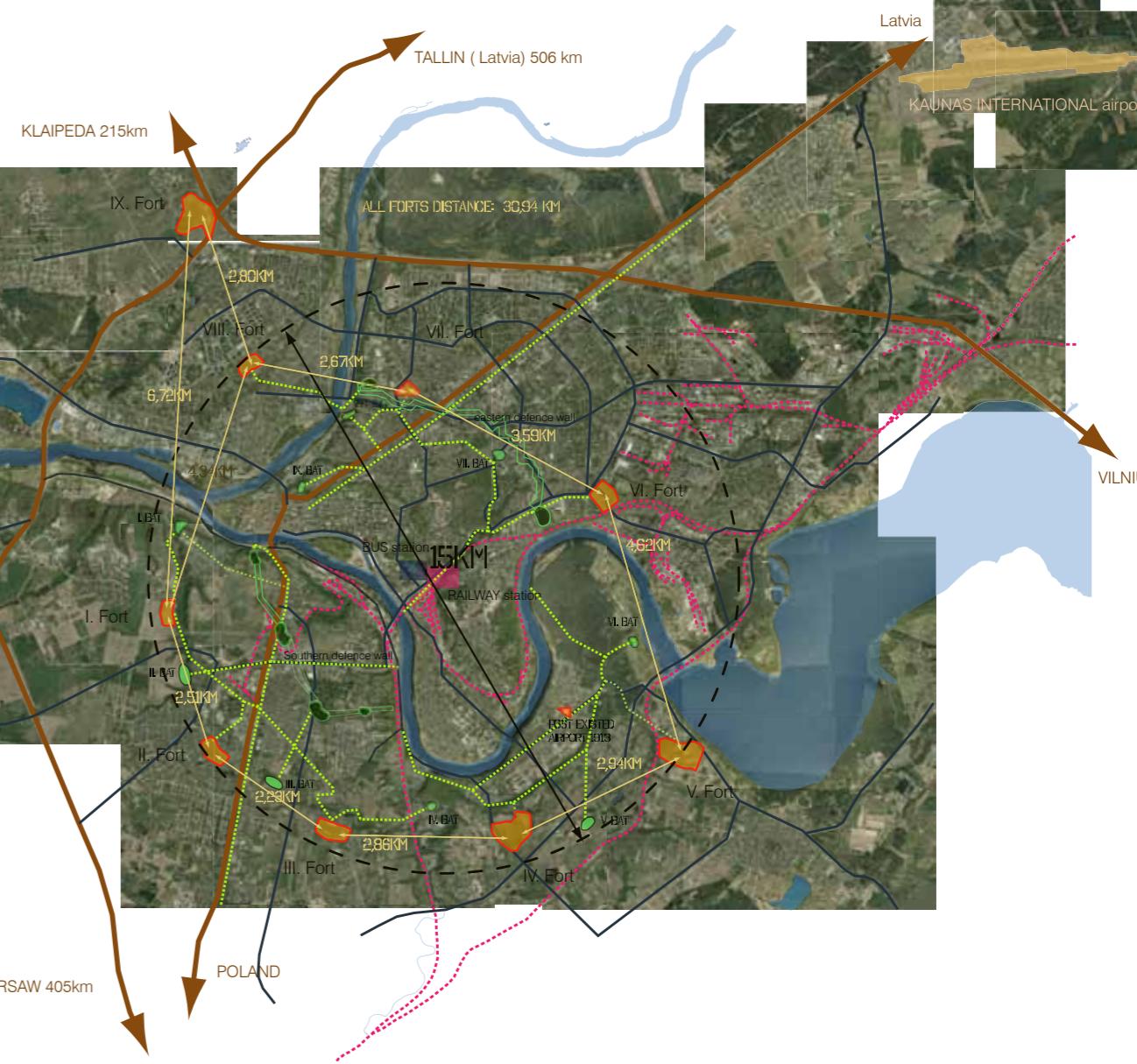
Fortifications in Kaunas gave unique significance for the Kaunas city, its planning, volumetric, special composition. On one hand it was limiting the height of the city, on the other hand it stopped the city from high-rise projects (which were undesirable for the distinctive and complicated landscape territories), influenced spontaneous, not always comfortable, but though distinctive, harmonical development of the city.

Military roads connecting the forts and other important objects of the Kaunas fortress had important strategical significance. In order to ensure the reliability of the roads and their protection, their coating was reinforced with stones, while the poplar trees were densely planted by the roadsides. Poplar were chosen because their roots are well developed, therefore they were used to reinforce the roads.

Later military roads became the main roads of the city. Street network was designed methodically according to the existing forts and military roads.



Forts on orhtophoto+infrastructure



43

ISSUES

After Kaunas fortress lost its defence function its fate was determined by different historic periods. After the 1st World War fortifications lost its strategic significance, were standing empty for a long time. Later they were used by Lithuanian Republic for many purposes (flats for the poor, workshops, national archive, jail). In the 2nd World war part of the forts became jails or extermination campuses. During the Soviet Union occupation times, military bases were established in most of the forts. Most of the fortification objects were devolved by city municipality. Though very slowly, the privatisation process is also under way. However the forts does not have defined land plots, so basically all the practice in the forts are not possible.

In order to define land plots (sklypai) special plan needs to be done. However municipality have no funds. Kaunas fortress is only remaining fortress of Russian empire in its entirely condition of which is envied by the fortification historians of Russia, Poland and Germany. Way less interesting fortification constructions become popular tourist attractions in the Western Europe countries. The current situation raises the problem of the future of the Fortress not only to the national but also to international level.

Many of the buildings of the fortress are abandoned and cause a threat to public safety.

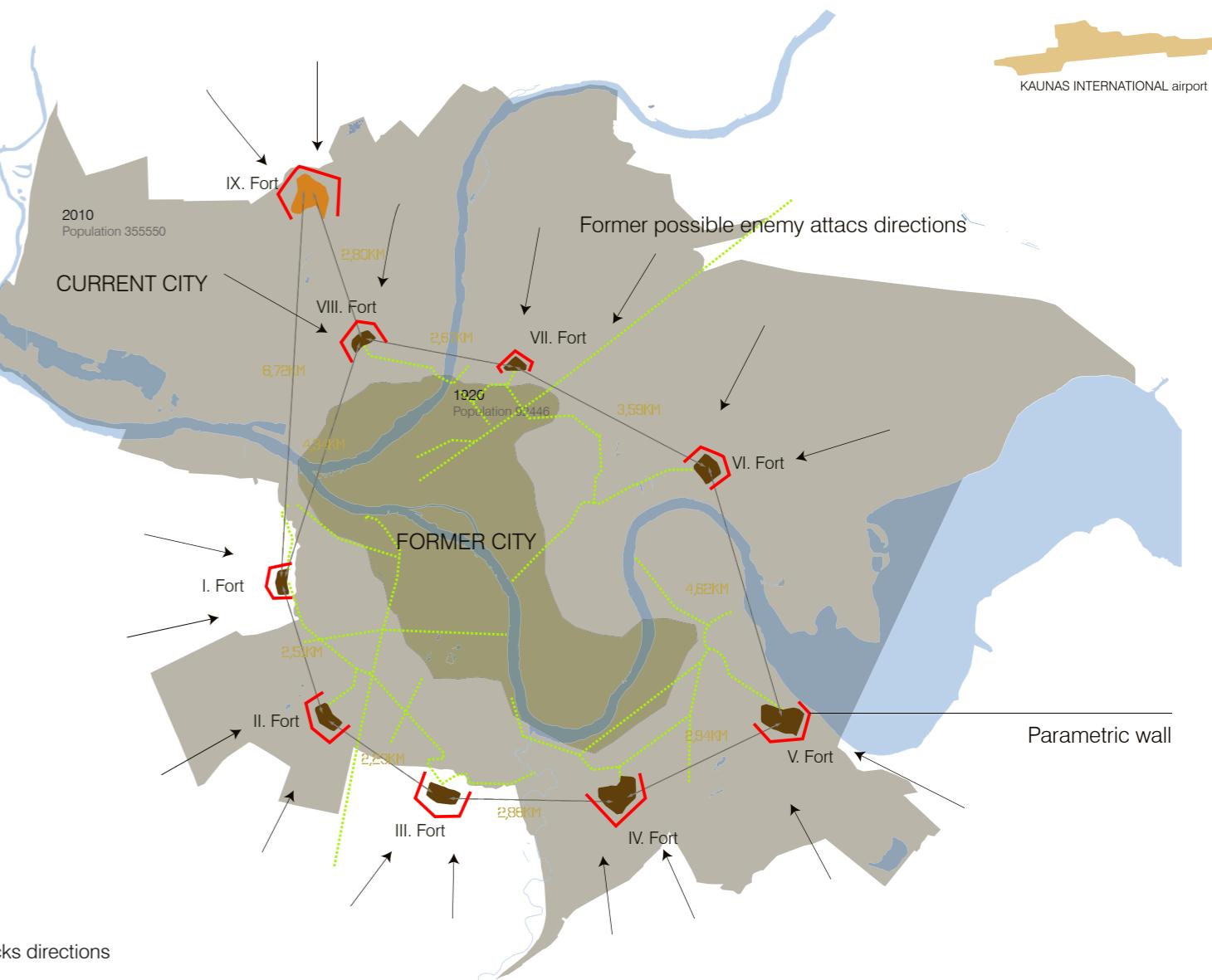
The main problem is publics attitude to the militaristic heritage.

It is necessary to change the publics understanding and to demonstrate that forts can be adapted to different purposes, which will be more beneficial than ruins that remind us of occupation.

- to connect history and future
- to adapt for new uses



DESERTED BATTLEFIELDS



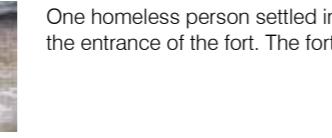
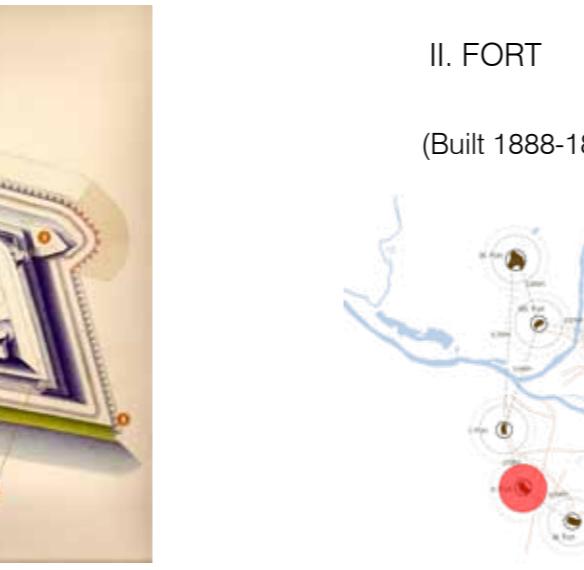
I. FORT

(Built 1888-1889, reconstructed 1893, 1908)



The fort is symmetric pentagon shape, the central section devides it into two equal wings. The forts are surrounded by the defensive ditch with a counterscarp wall. The casemated structures are red-brick, later reinforcements are built of concrete.

The fort is oriented to the west. It is of the least urbanized Kaunas forts. During the war period was damaged, however, still holds its primary relief, well seen in the surrounding territory.

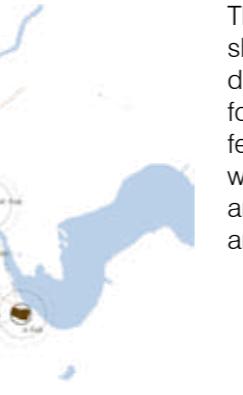


One homeless person settled in the abandoned house, right at the entrance of the fort. The fort territory is cleaned by him.



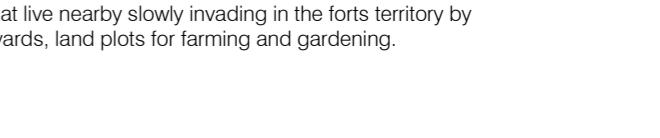
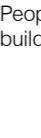
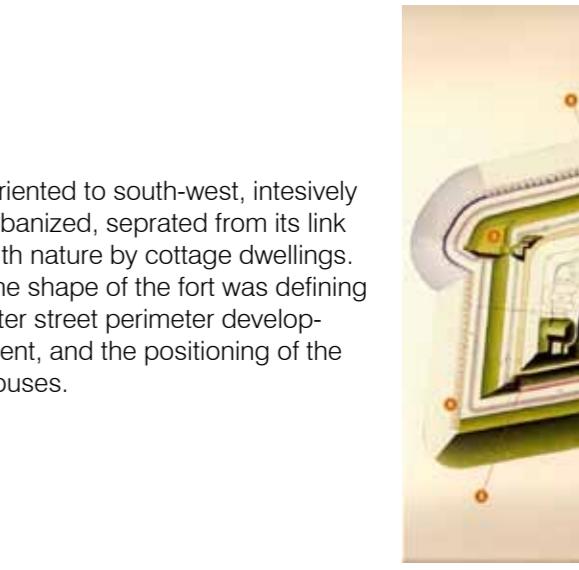
II. FORT

(Built 1888-1889, reconstructed 1893, 1908)

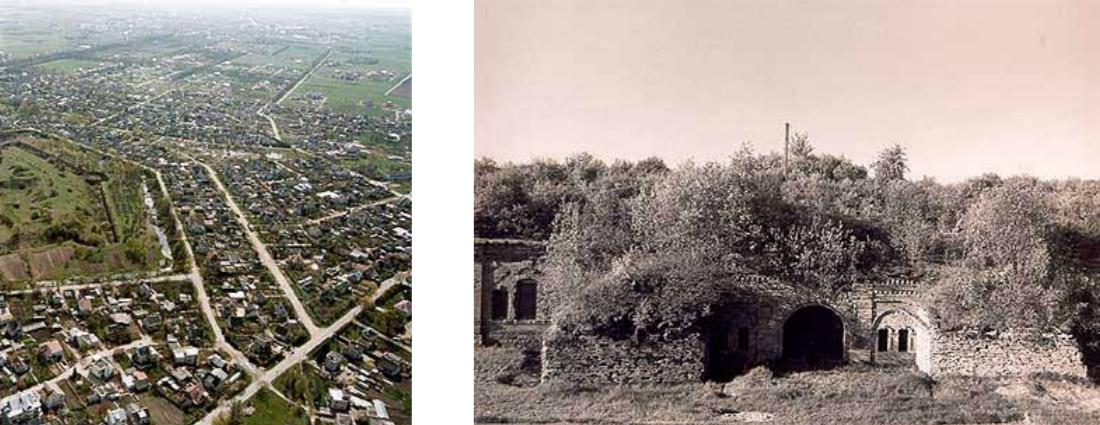


The fort is a symmetric pentagon shape, the central section divides it into two equal wings. The forts are surrounded by the defensive ditch with a counterscarp wall. The casemated structures are red-brick, later reinforcements are built of concrete.

Oriented to south-west, intensively urbanized, separated from its link with nature by cottage dwellings. The shape of the fort was defining later street perimeter development, and the positioning of the houses.



People that live nearby slowly invading in the fort's territory by building yards, land plots for farming and gardening.



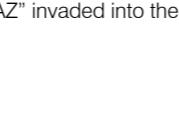
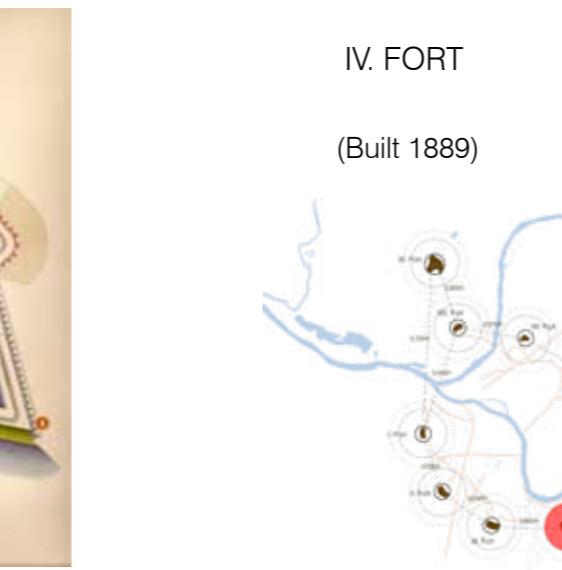
III. FORT

(Built 1887-1888, reconstructed 1893-1898 and 1908)

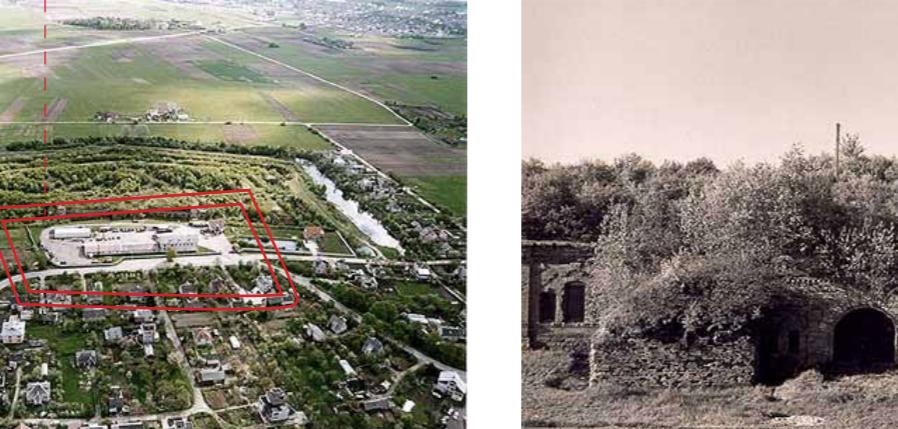


The fort is a symmetric pentagon shape, the central section deviates it into two equal wings. The forts are surrounded by the defensive ditch with a counterscarp wall. The casemated structures are red-brick, later reinforcements are built of concrete.

Fort territory is highly covered with unplanned vegetation. From the east and the south it's not urbanized. From the west and the north it's urbanized by cottage dwellings.



Commercial organization "GAZ" invaded into the fort territory



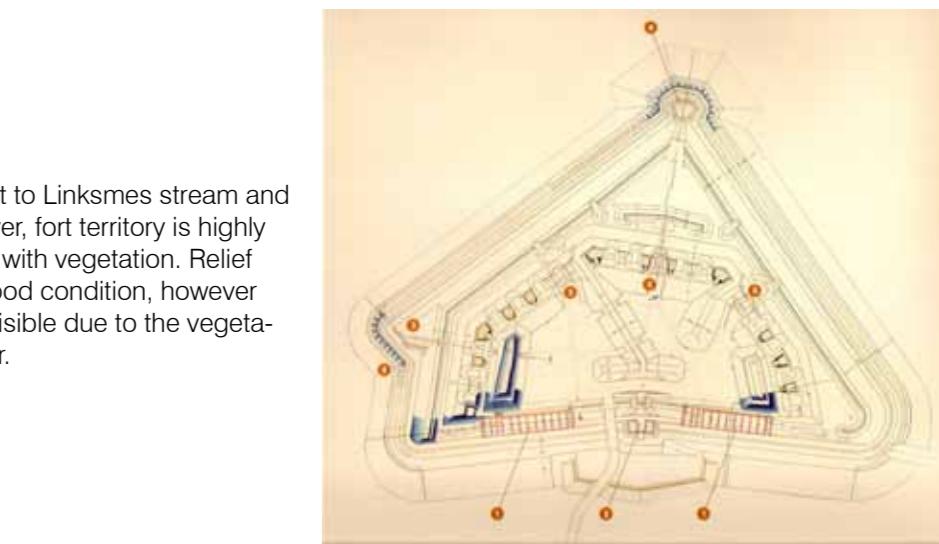
IV. FORT

(Built 1889)



The fort has triangular form, the plan is typical but modified. It has significant importance compared to the other fortress objects, because it has two cannon lifting mechanism casemates.

Built next to Linksmes stream and Jiesia river, fort territory is highly covered with vegetation. Relief has a good condition, however it's not visible due to the vegetation layer.



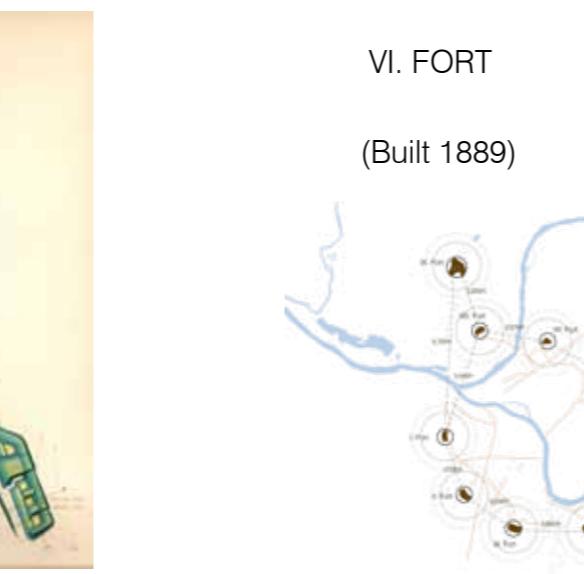
V. FORT

(Built 1889)



The fort has an asymmetric hexagon shape. The central bisector (section line) divides it into unequal wings. The fort is surrounded by the defensive ditch with counterscarp wall, the casemated structures are red-brick.

It is situated next to Semena stream, also close to Kauno marios. Big part of the fort territory is covered by unplanned vegetation. It is strategically in a very good location, accessible from major motorways and Kaunas international airport.



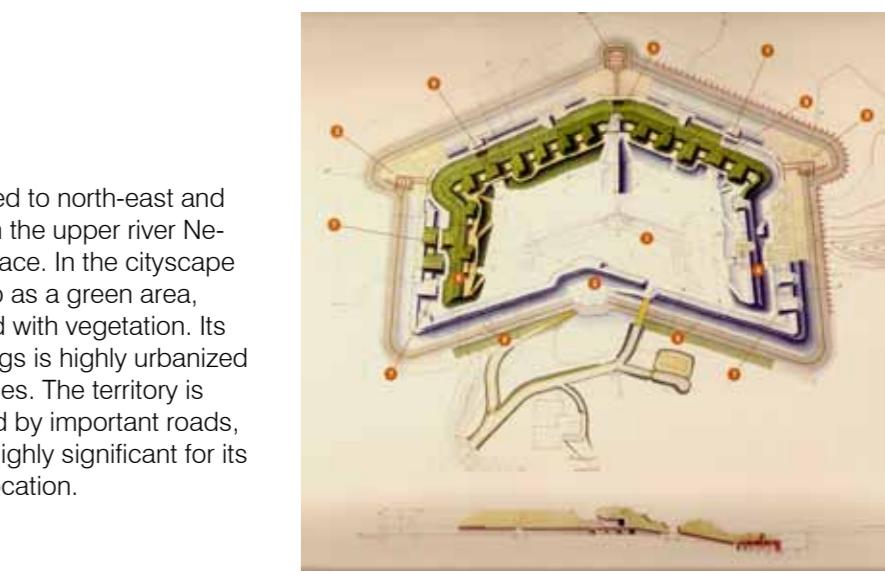
VI. FORT

(Built 1889)



The fort has a symmetric pentagon shape.

Fort oriented to north-east and situated on the upper river Nemunas terrace. In the cityscape it opens up as a green area, hill covered with vegetation. Its surroundings is highly urbanized from all sides. The territory is surrounded by important roads, making it highly significant for its strategic location.



VII. FORT

(Built 1889)



The fort has a symmetric shape. In 2009, the fort was purchased as a private property, and its restoration works were announced. It has been converted into a military history museum, and also a place for some open air events.

The surrounding territory is highly urbanized. From the south is surrounded by the industrial complex, from the west by the educational hospital. It is situated close to the city centre, abandoned for many years do not fulfil its function. After the privatization the fort was cleaned, the main building turned into museum.

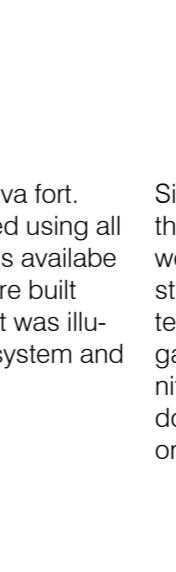


VIII.(Linkuvos) FORT

(Built 1889-1890)



Most often called Linkuva fort. The fort was constructed using all the newest technologies available then: its casemates were built using concrete. The fort territory is used for farming and gardening by the local community. It is highly urbanized and does not play the role of the park or a square.



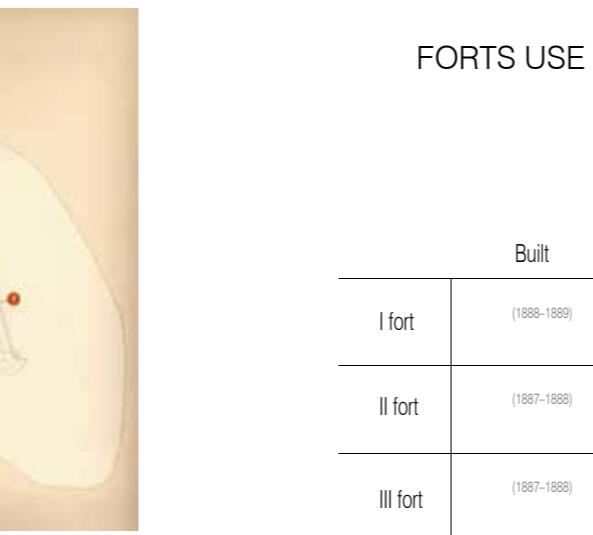
X. FORT

Built 1901-1913)



It is the only fort built out of concrete. The second ring planned for the fort was situated next to an important railway junction.

A detailed anatomical diagram of a dental implant. It shows a cross-section of the implant body (1) integrated into a bone structure. The internal components include a central screw (2), a shoulder (3), and a neck (4). A gingival flap (5) is shown covering the top of the implant. Various numbered callouts (1 through 10) point to specific parts: 1 points to the top of the implant body; 2 points to the central screw; 3 points to the shoulder; 4 points to the neck; 5 points to the gingival flap; 6 points to the bone tissue; 7 points to the soft tissue; 8 points to the gingival tissue; 9 points to the bone-implant interface; and 10 points to the top edge of the implant body.



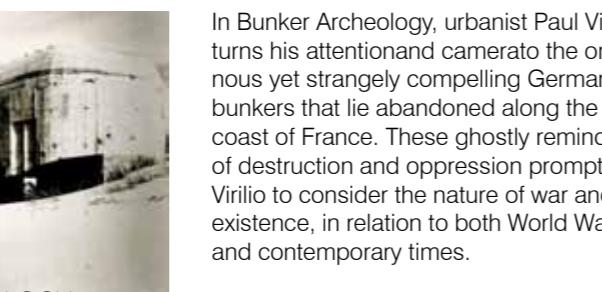
					
			July of 1941 seven prison camps were set up in Kaunas, the largest of which were located in VI and II forts. In 1941–1942, 35000 prisoners of war died there of physical exhaustion and diseases.		
					
			1941 08 Massive Jewish killing campus Jewish from Kaunas Ghetto		
					Paintball
First occupation (1915–1918)	First Republic of Lithuania (1918–1940)	First Soviet occupation (1940–1941)	German occupation (1941–1944)	Second soviet occupation (1944–1990)	Second Republic of Lithuania (1990–present)
			1941-1943 Campus of keeping Russian war captives 1943-1944 Campus of keeping civilian captives A picture by S. Podorožnias, an artist and former prisoner of war	1944-1948 Campus of keeping German war captives	
Archive of Kaunas county			Massive Jewish killing campus		2009 privatized by " War heritage centre" used for cultural educational purposes
			1941 Massive Jewish killing campus		Jail 1958 Museum holocaust remembrance symbol, was established
	1924 Fort used as heavy works Jail	1941 Massive Jewish killing campus			1984-present New Museum was built

KAUNAS FORTRESS

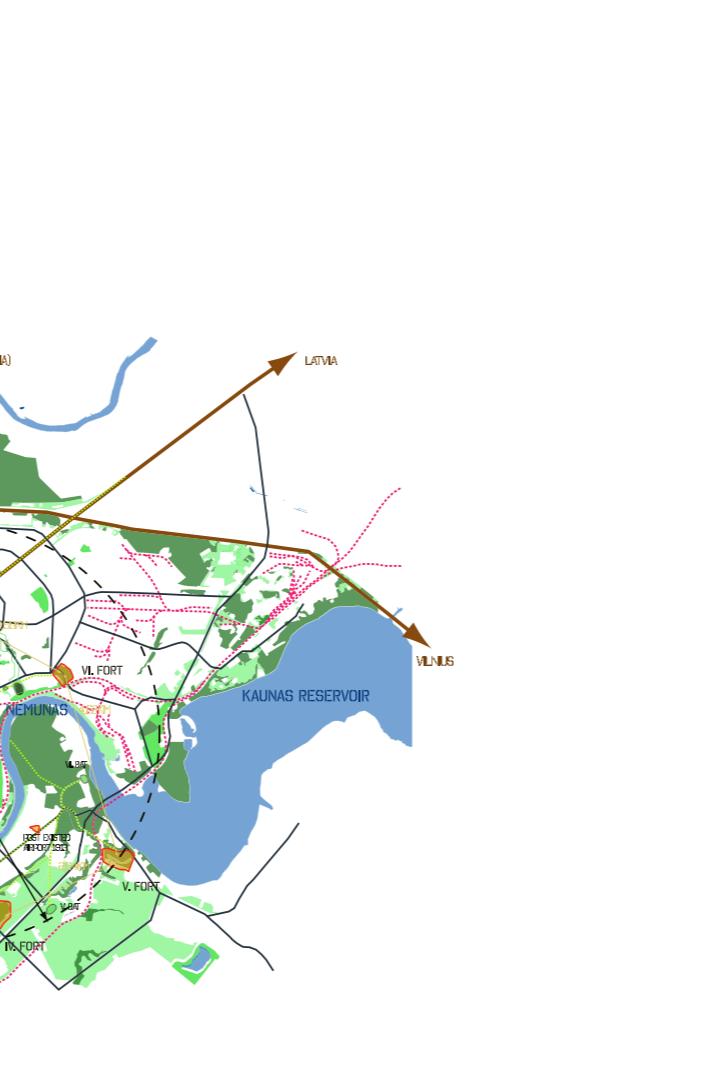
The Kaunas fortress is a unique cultural heritage object in the context of the European defence heritage. At different historic periods, a great number of fortresses and fortified regions were erected in Europe. In our days this war legacy has a cultural significance.

The remaining fortification objects greatly influence tourism; they often become the pinpoints on a tourist's itineraries. Integration of Kaunas fortress into the general cultural network of European fortresses is an essential objective for the future. Lengthy work of qualified specialists in various fields, investments into research of fortress objects, and their protection are necessary for achieving this goal. The experience of foreign countries shows that the investment into the cultural heritage is an efficient way to develop tourism, establish and popularize the image of the city and country at the international level.

REF [B]



BUNKER ARCHEOLOGY
Paul Virilio



3. PROPOSAL

3.01 ACTORS

I. FORT

USERS: locals, tourists, general public

[FU]



"Aleksotas" funicular (panoramic view of Kaunas)

[A]



Airport- used for the airshows

[M]



Education park, Aviation base

[AG]



Aviation museum

[RL]

Agricultural land
Railway line (not used)

[FO]



Forestry land

[OT]



Infront of the Kaunas old town



II. FORT

[CO]



USERS: locals

[C]



Commercial area (kettle sales)



[IN]



Metal manufacturing

[D]

Intensively urbanized by cottage dwellings
Education park, Research base

III. FORT

USERS: locals

[AG]



Agricultural land

[C]



Commercial-Gaza-groservisas (in the fort territory)

[D]

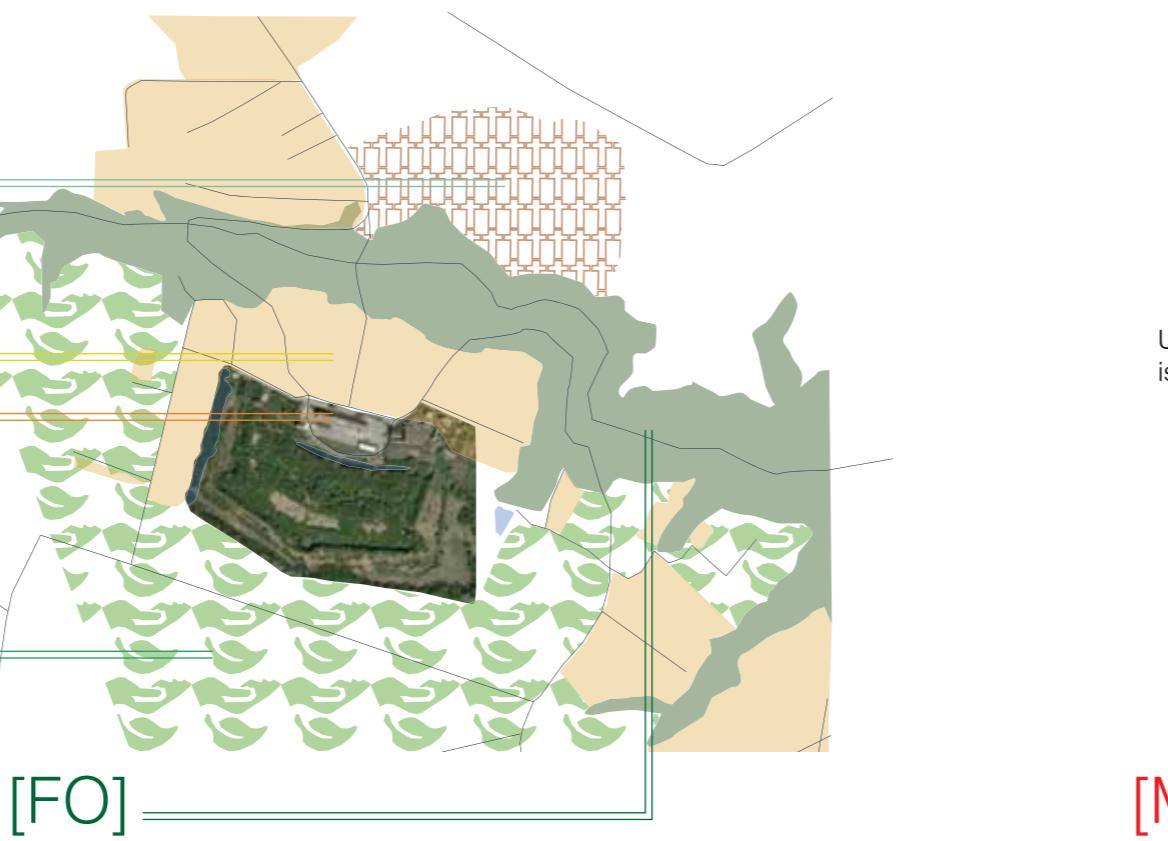


Intensively urbanized north part of the fort

[SC]



Seniava Cemetery



IV. FORT

USERS: scientists, specialists, general public, tourists

[MI]



Lithuanian military
"Material resource department"

[G]



Surrounded by green spaces

[NR]



Fort - Nature reserve,
Bat reservat

[FO]



Forestry land

[D]



Intensively urbanized north part of the fort

[D]



Education park,
Research base

Diving

V. FORT

USERS: locals, tourists, general public

[W]

[IN]

[PB] Park
Water sports club

[FO]

[D]



Kaunas reservoir (the biggest artificial water body in Lithuania)



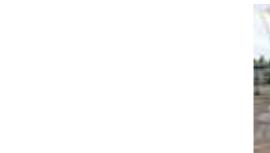
Kaunas hydroelectric power



Paintball activities- harmful for the heritage



Forestry land



Intesively urbanized from the north and the south



VI. FORT

USERS: locals, tourists, general public, industries

[IN]

[PB]

[P]

[IN]

[RL]

[D]

[C]



Cast iron foundry "Centrotitas"



Paintball activities- harmful for the heritage



Police



Railway line



Intesively urbanized low-rise dwellings

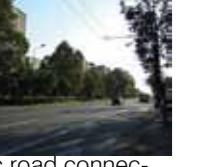


Commercial "UAB Marguva" gun shop

VII. FORT

USERS: locals, tourists, general public

[R]



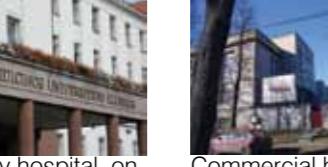
Has road connection Via Baltica

[D]



Intensively urbanized low-rise dwellings

[ED]



University hospital on the west side of the fort territory

[C]

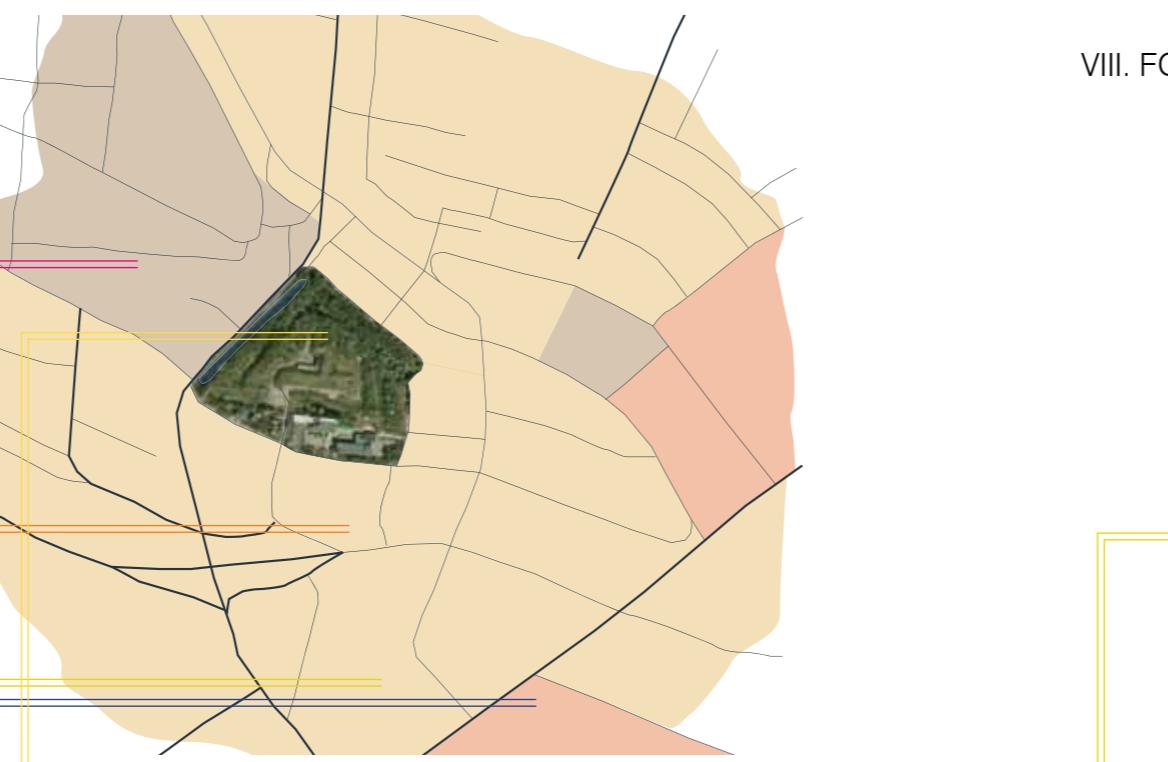


Commercial buildings at the southern entrance of the fort

[P]



Privatized by "War heritage centre"



VIII. FORT

Park,
Urban agriculture
School collaboration
(education)

[D]



Intensively urbanized cottage dwellings

[UF]



Fort slopes used for vegetable gardening

[C]



Has some small commercial areas

[ED]



Public buildings-schools

[D]



Diving



IX. FORT



PROPOSITION PROGRAMMES



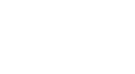
Education



Urban farming



Restaurant



Leisure



Lookout points



Underwater archeology club



Museum



Industry



Bat protection centre



Market

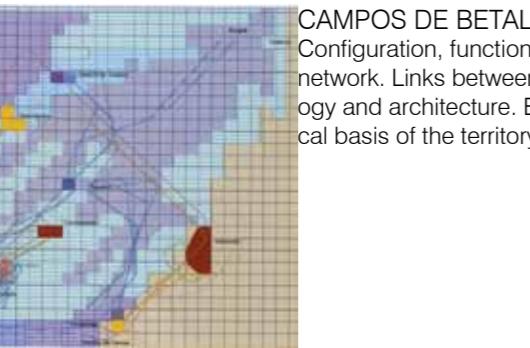


NETWORK

Each object of Kaunas circular fortress lies in a different context. Therefore they can be adapted to different programmes, according to who is going to be their users, and on their strategic location.

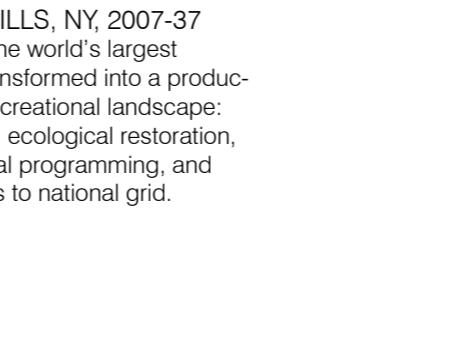
Forts have the same physical boundaries, structures, spaces that would have similar adaption solutions. *How could the forts be transformed??*

REF [C]

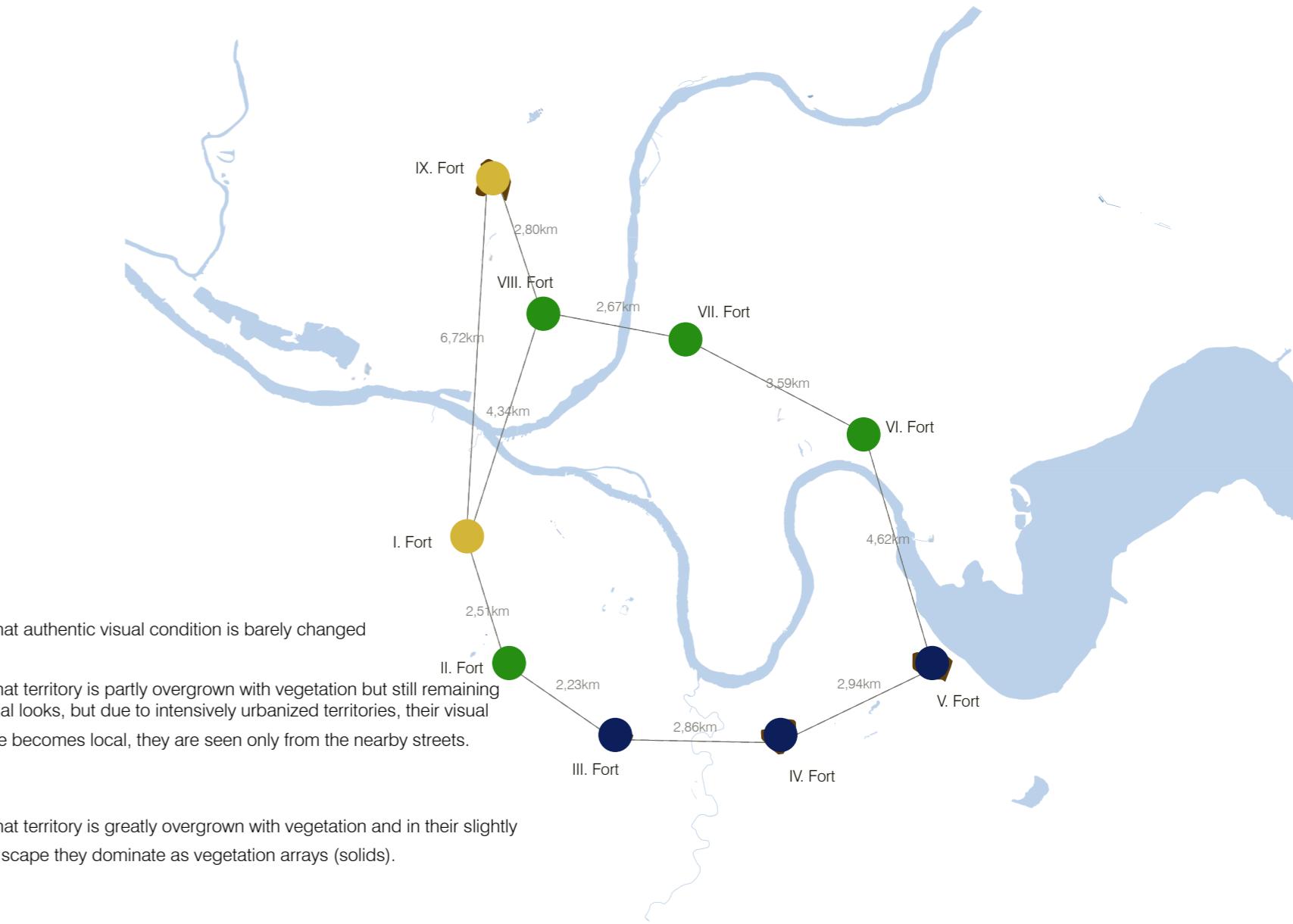
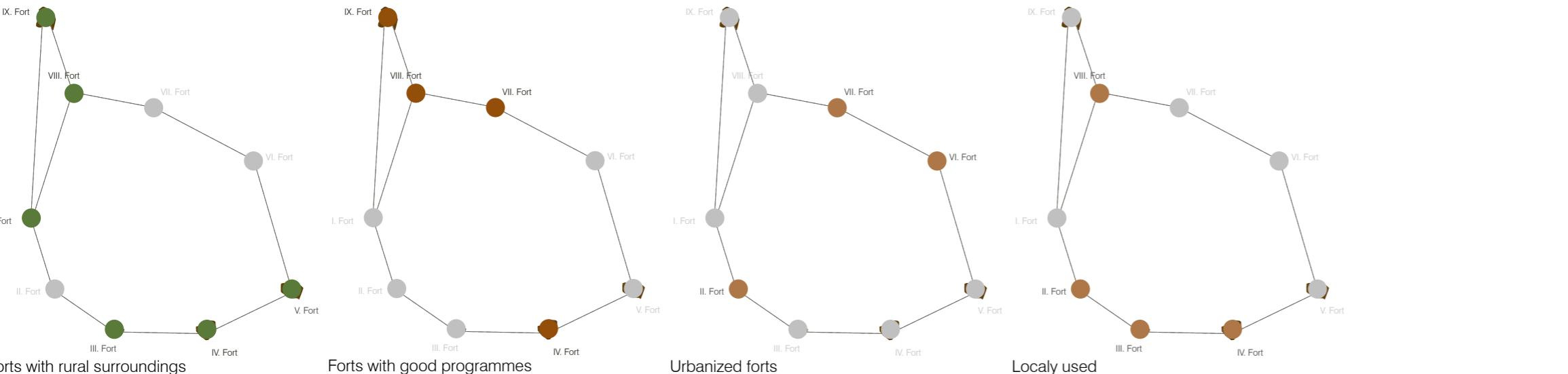


CAMPOS DE BETALLA
Configuration, functions and network. Links between ecology and architecture. Ecological basis of the territory.

REF [D]



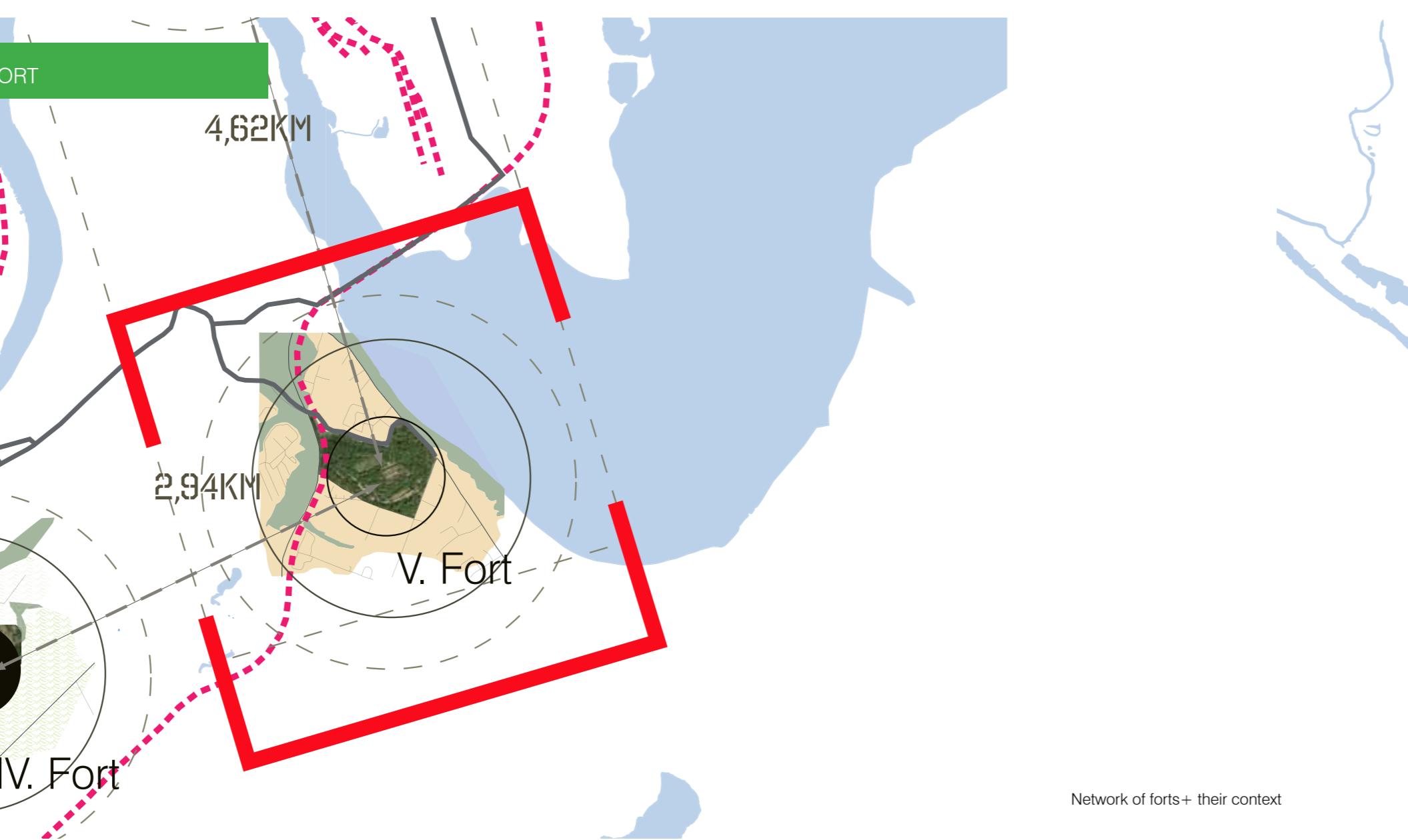
FRESH KILLS, NY, 2007-37
Formerly the world's largest landfill- transformed into a productive and recreational landscape: recreation, ecological restoration, educational programming, and sale of gas to national grid.



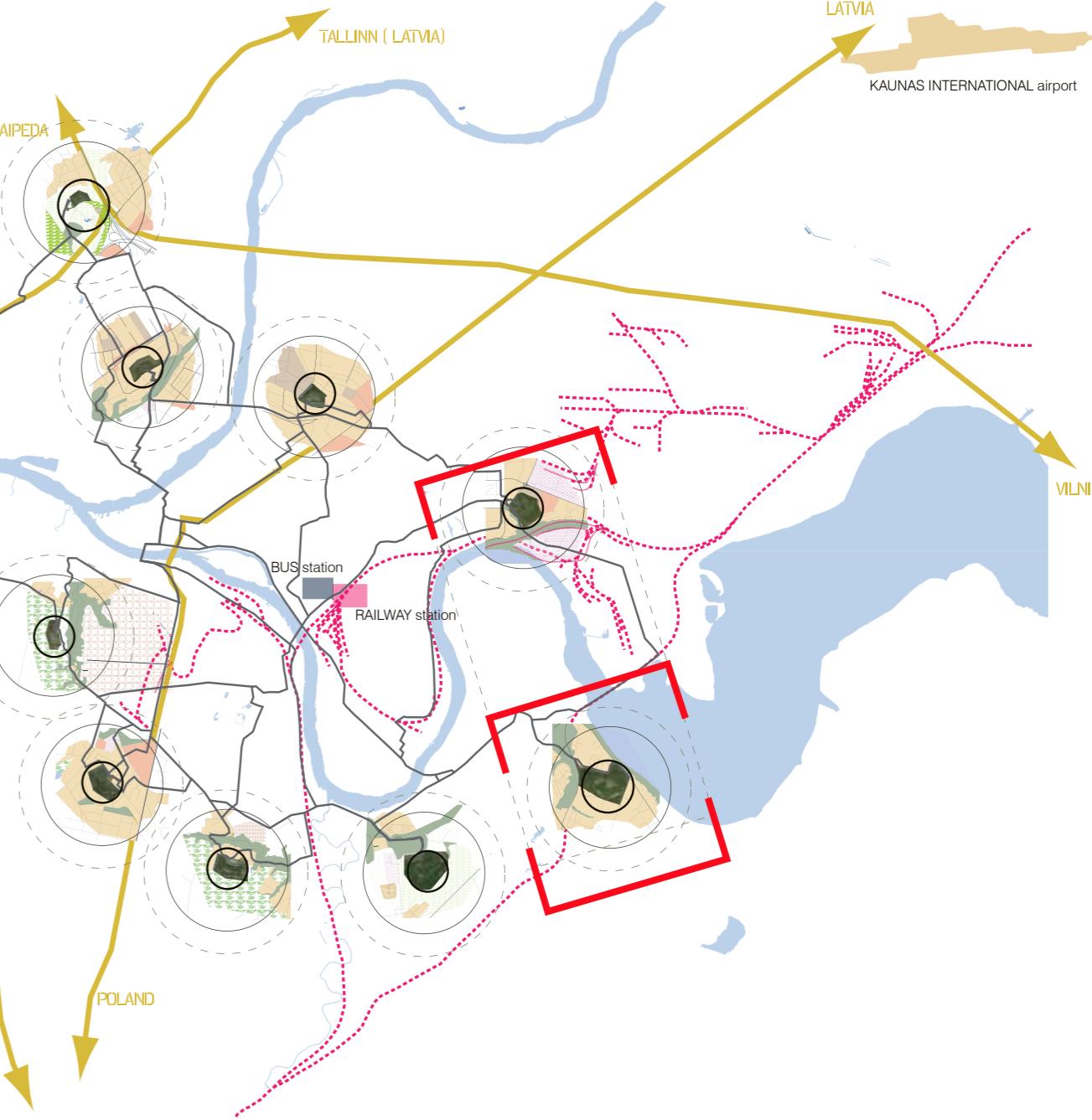
3. PROPOSAL

3.03 Vth FORT

I chose to work with the fort number V. It triggered my curiosity due to its strategic location (on the edge of the water, next to the water body Kauno marios), accessible from Kaunas international airport. The Vth fort has also high potential for its leisure activities.



Network of forts+ their context



SITE

I built the model of the Vth forts territory, to better understand the spatial qualities of the existing relief, which is not so significant in the top view. Once you enter the territory of the fort, then you get amazed by the man-made topography, and its mass.



Model of one territory and its relief

REF [E]

IGUALADA CEMETERY
Enric Miralles and Carme Pinós
1984



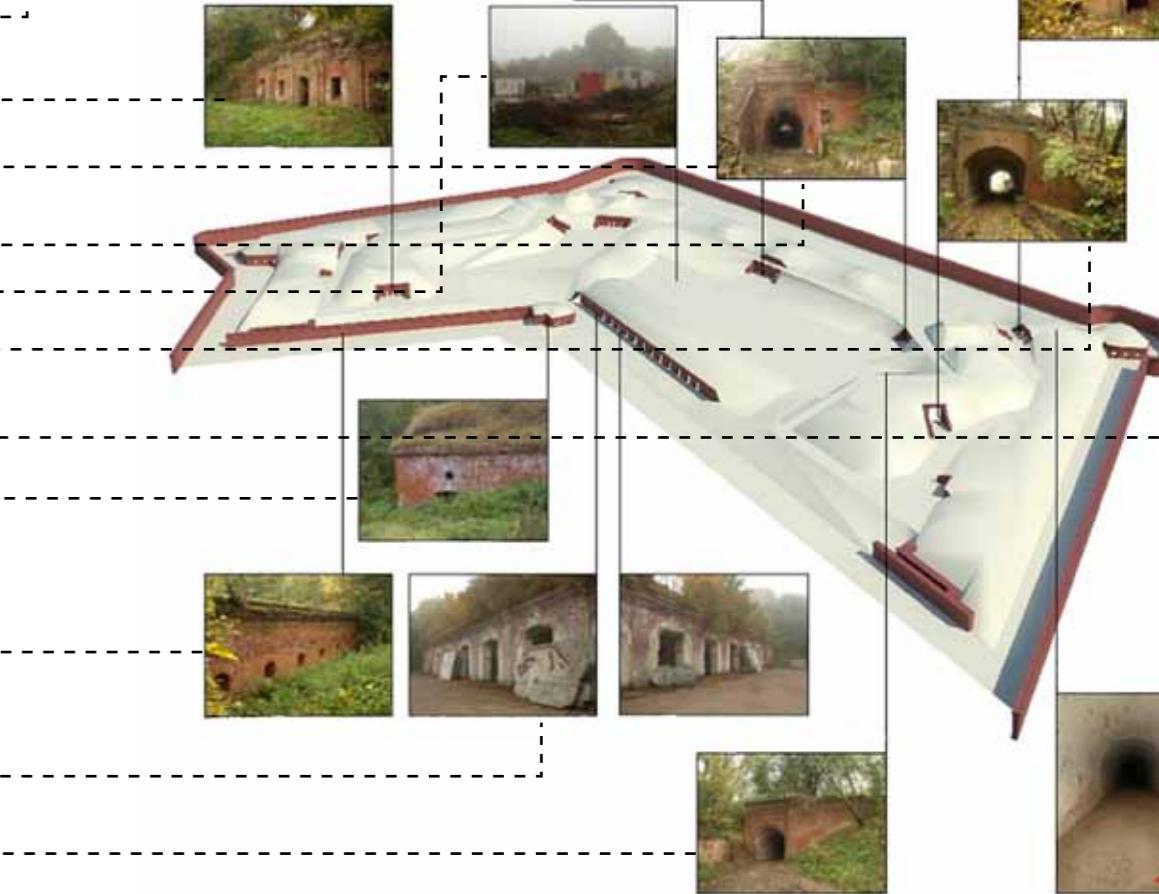
The project is conceived, in part, as an earthwork that transforms the surrounding landscape and also, in part, as a metaphor for the river of life. A processional "street" descends from the entrance, where crossed, rusting, steel poles doubling as gates and likened to the crosses at Calvary, proclaim the start of a winding pathway towards the burial area.



Model of one territory and its relief+ underground structures

Vth FORT EXISTING STRUCTURES

Ammunition magazine



Ammunition magazine



Shelter



Ammunition magazine



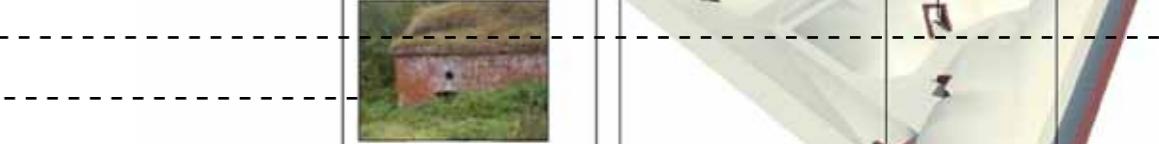
Inner yard



Postern to central caponier



Central caponier



Rear caponier



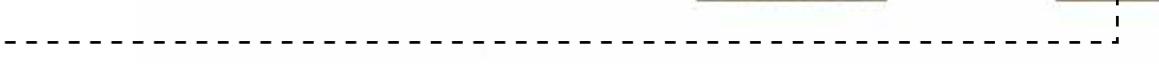
Rifle galleries



Barracks



Shelter



Postern to central caponier

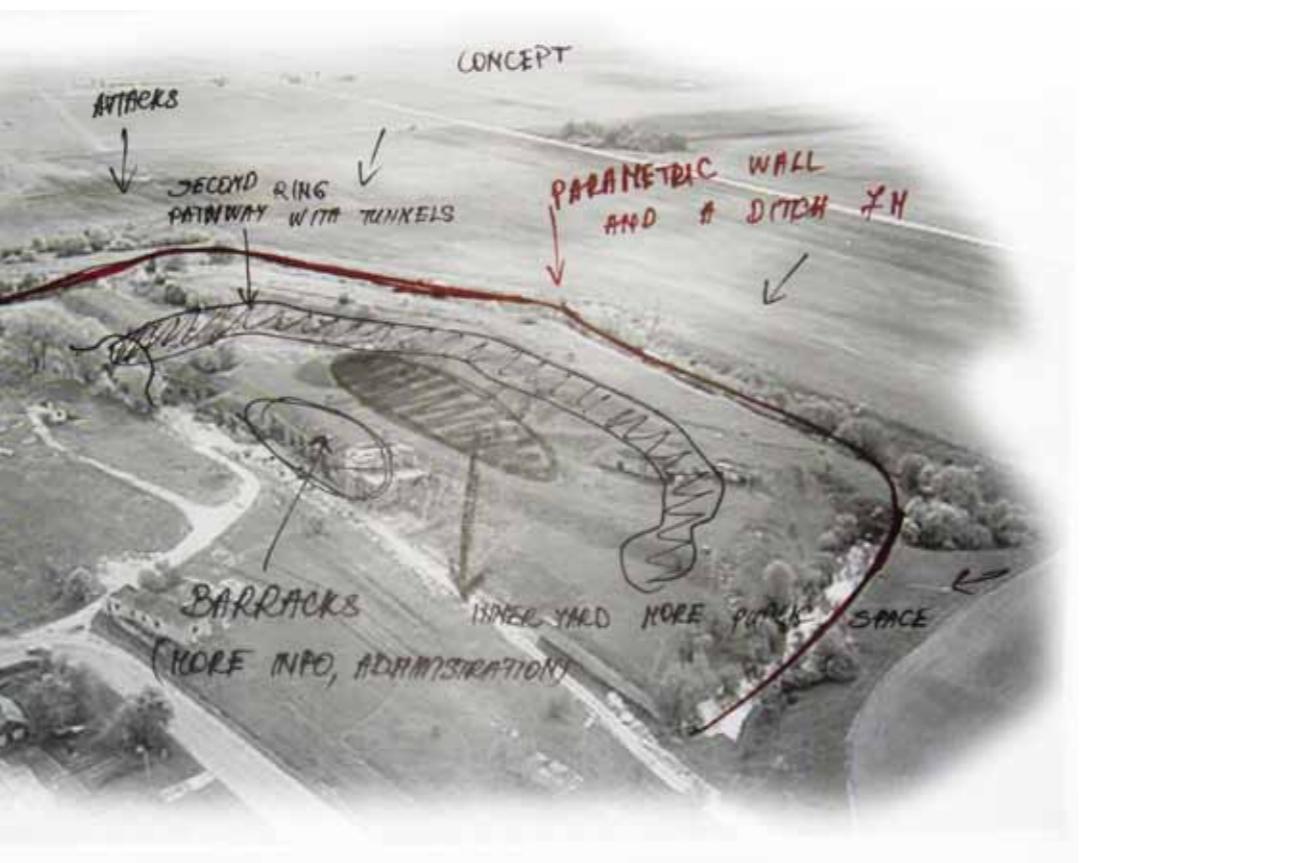
FORT STRUCTURES AND LOGICS

All forts have their own significant shape, they lie down in a different context. However they all have very similar physical objects, spaces. Each fort has barracks, ammunition magazines, shelters.

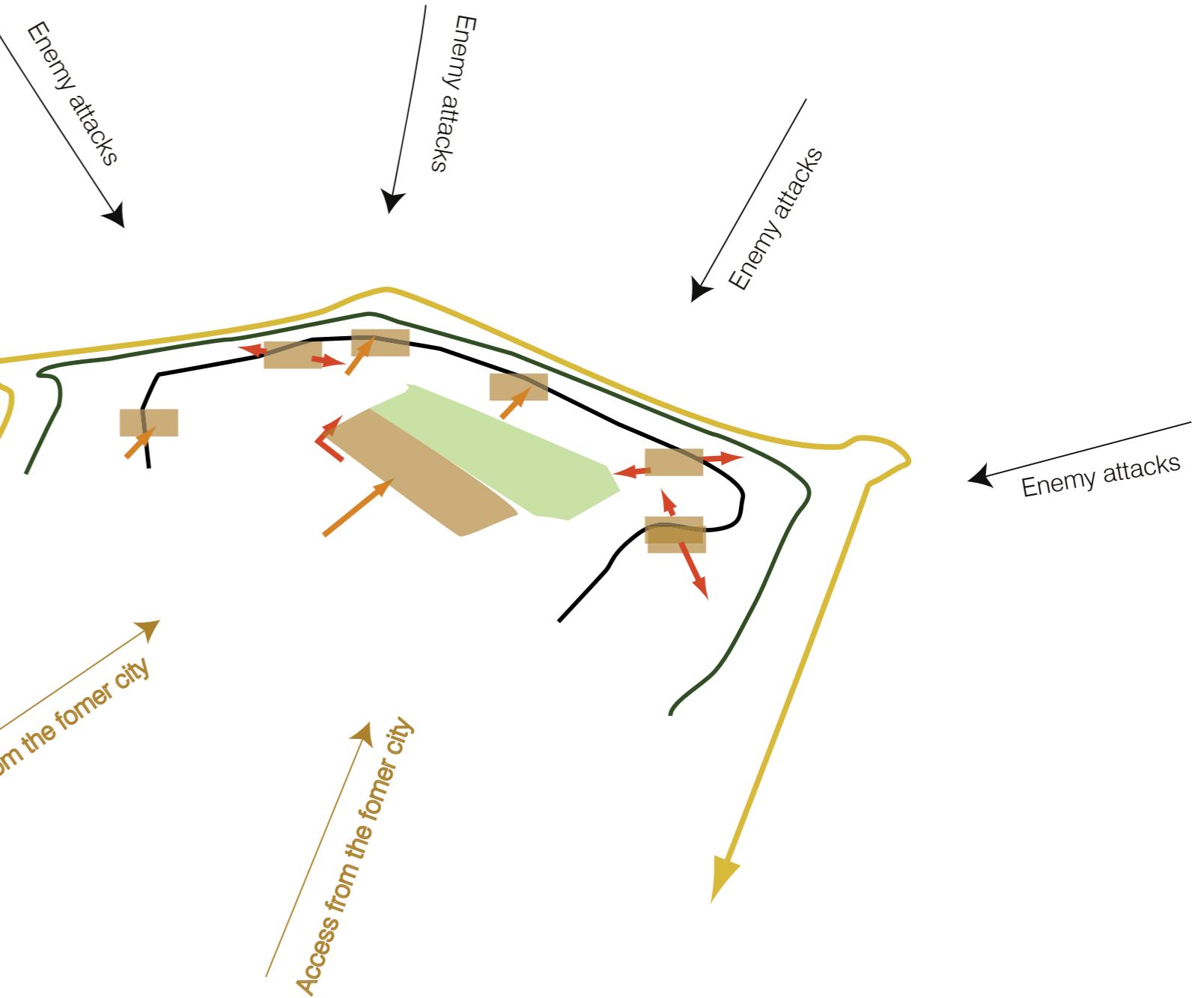
Understanding the logic of the original fort, will help to understand how to approach the structures and adapt it for new uses.



Model of one structure to better understand the phenomenon of the fort structures



MOVEMENT



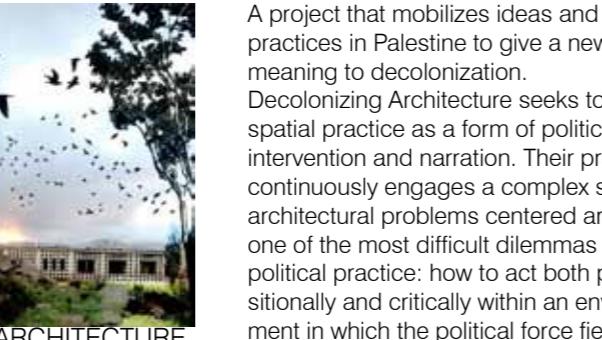
STRUCTURE DAMAGE ANALYSIS

Maps do not reveal the true situation of the fort. Therefore, structural analysis was done. The structures in the fort are decaying. The decay is mainly caused by moisture - the destruction of a former top trims, fronts breaking rainfall. The facades are adjacent to lands dikes, led to an erosion of solid green, growing just above the buildings. Their roots are concentrated in the brick masonry and, in some places is difficult to distinguish where is the building wall and where is the entering for the earth embankment.

The outer defense ditch is flooded because large trees destroyed the drainage layer. Formed new layer of land placed a strain on the former drainage ditch. Drain the water from the ditch disrupted his back at the Western lands. Constant humidity destroys counterscarp wall, which is surrounded by a ditch. But so far they are in good condition. Less affected by moisture from the brick wall in the western part of the fort.

After the Second World War, new structures were built - structures neologisms good physical condition, but some of them devastated - extended doors, windows , etc. Some of the buildings fell into ruin. In my opinion, these structures should be removed from the fort area, damaging the monument because of the architectural image.

REF [F]



A project that mobilizes ideas and spatial practices in Palestine to give a new meaning to decolonization. Decolonizing Architecture seeks to use spatial practice as a form of political intervention and narration. Their practice continuously engages a complex set of architectural problems centered around one of the most difficult dilemmas of political practice: how to act both propositionally and critically within an environment in which the political force field, as complex as it may be, is so dramatically skewed.

As a first stage of design proposed to perforate the buildings of the military base by drilling holes into their walls. When the building is finally appropriated these would render walls into screens. Another way of intervention within the base is to transform its landscape. The earth rampart raised around the buildings has been constantly shifting due to Palestinian contractors using the site as a dump for their unwanted rubble and to other contractors taking some of the earth from the rampart as material for construction.

- Covered with soil
- Flooded or humid
- Collapsed or partially collapsed



VEGETATION ANALYSIS

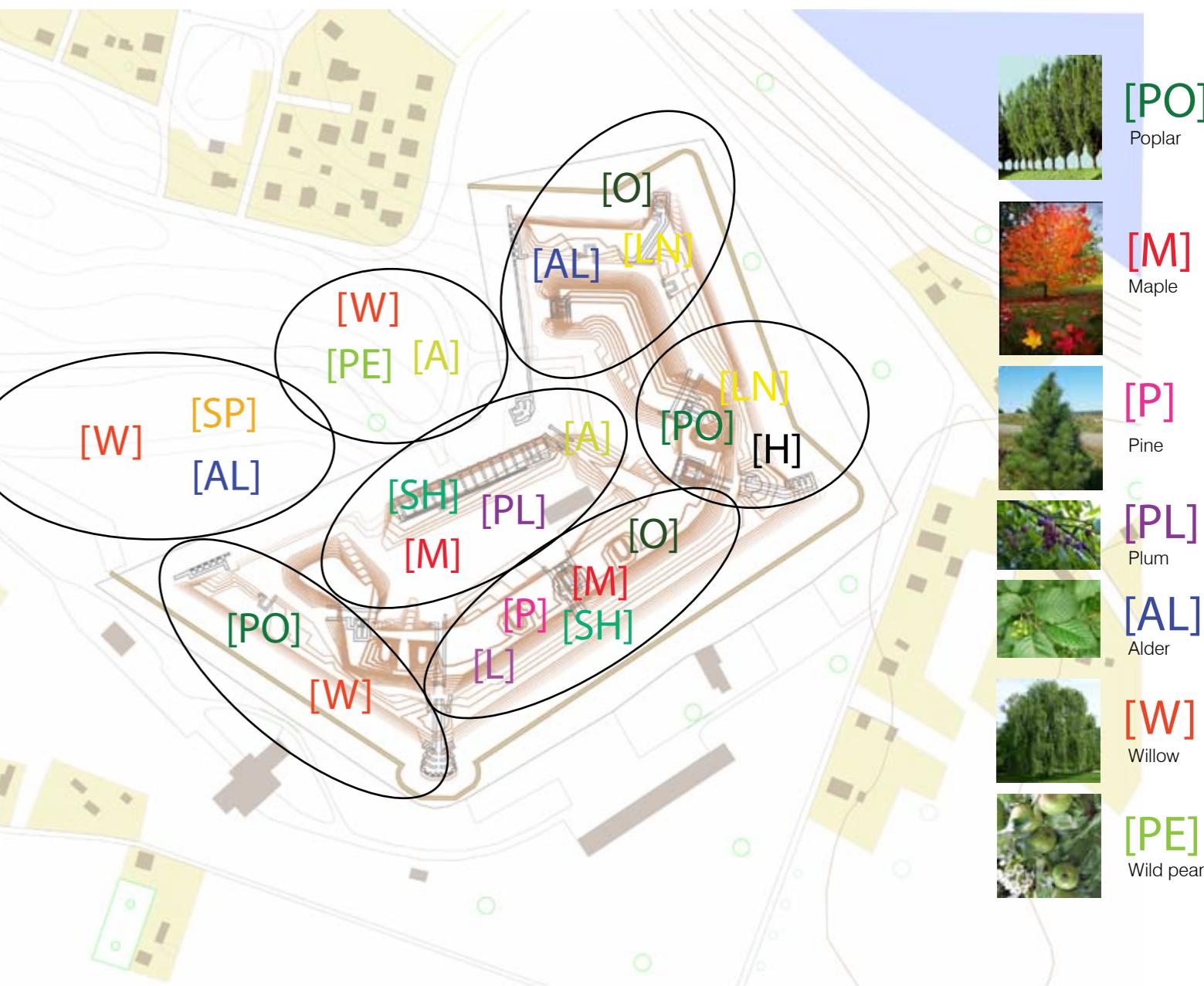
Big part of the fort is covered with vegetation. It is in a crossfire between conservation and nature protection. The forts land plots are not planned, therefore, they can not be privatized. The municipality of Kaunas does not have enough finance to proceed the further investigations of the forts. In 2006 with the initiative of one architect, Nijole Steponaitite, the vegetation analysis was made. The situation now has changed, more and more trees are invading in the forts territory.

The 5th fort is highly covered with vegetation, letting the area not accessible and movable. There are a few trees that are to be protected, however due to the other vegetation they are loosing their significance.

5th fort was divided into the 7 land plots, each of them was investigated and described in the document : "Buvusios Kauno tvirtoves 1,2,3,4,5,6,7,8,9 fortu zeldiniu iveritinimas bei issaugojimo ir tvarkymo siulymai". Architect Nijole Steponaitite is proposing a plan how to take care of the forts territory.

3 STAGES OF THE PROPOSAL:

- remove all vegetation from the structures and their physical protection zones, in the defensive ditches, regenerate the lawn layer.
- remove all vegetation from all the fort territory, leaving valuable tree species, regenerate the lawn layer.
- remove all vegetation from the forts protection zone, leaving the valuable tree species. Form a park in the fort territory and surrounding area according to the special plan



CIDER FARM SYSTEM

Further vegetation analysis showed possibility for using the space as a productive landscape.

With this project I want to focus on creating productive landscapes and urbanism that provide ecological and economic benefits, thereby, creating a platform for social interaction and growth.

REF [G]



THE COOK SCHOOL

The existing fruit trees can be used for cider production and the capacity can be expanded into the surrounding territories. The 5th fort should become a place for the public, locals, tourists.

The fort would work as a community centre, people could come with their own harvest, participate into the cider making process.

The Cook School is a place for fifteen people to work, live and learn "off grid" for a year. It is located in Braco, a rural and distinctive landscape in Perthshire, and home to one of the finest examples of a Roman fort in Britain. It was for this reason I felt it essential not to overpower the site's ancient authority but to enhance the special quality it has as a ruin. The Cook School is a building based on simple architectural principles that respond to their context through light, material and function.

It sits gently within its delicate setting but continues and amplifies its surroundings. I drew on the passive ideals of hermits and monastic communities as ancient environmental precedents. The scheme reinterprets and becomes part of the lost ramparts, destroyed by previous settlements, through the use of materials and forms that work well close to the ground. The building hence creates a direct relationship with the growing and cultivation of food at a very human scale.

01. CULTIVATION



CIDER PRODUCTION

02. HARVEST



Apples per tree amount depends on the tree size

03. PROCESS



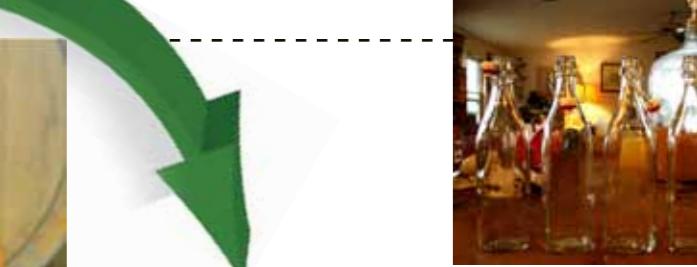
03.a) juice press
15-20 kg of apples produce 10 litres of juice.

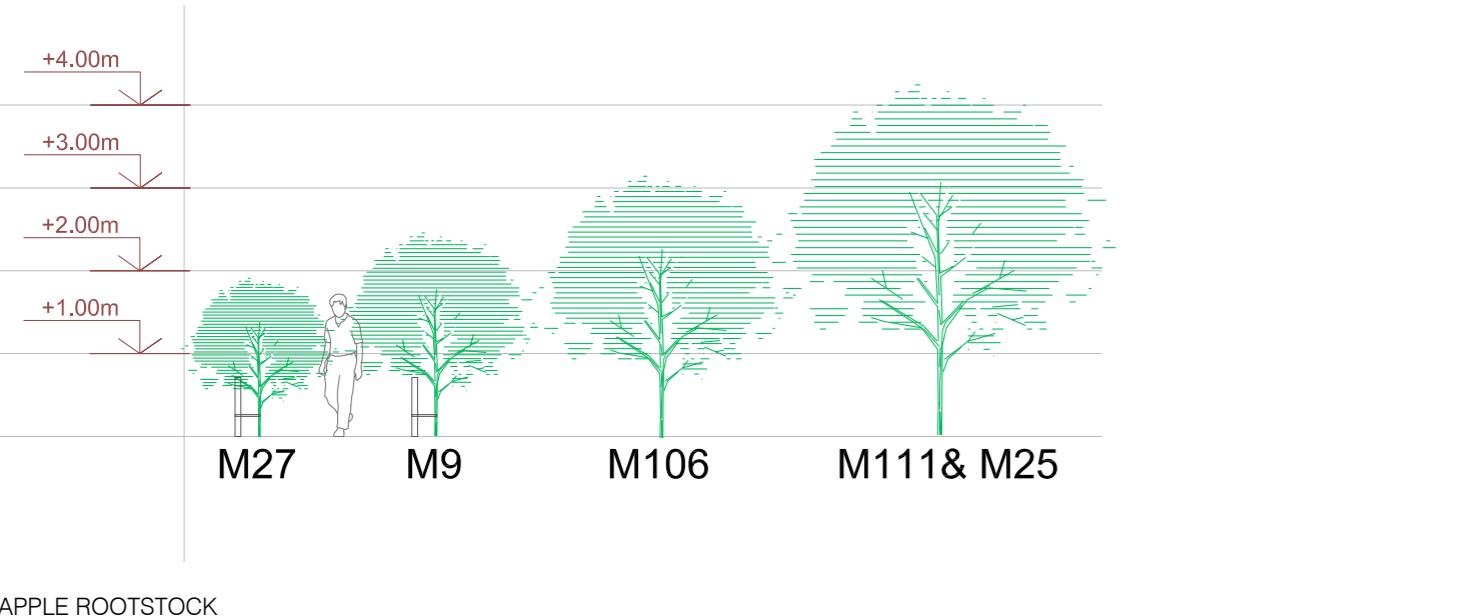
03. b) fermentation



Fermentation is carried out at a temperature of 4-16 degrees C.
It takes 3 months ready to drink, more commonly matured for 2-3 years.

04. PACK, STORE, TRANSPORT





APPLE ROOTSTOCK

TERMS VOCABULARY:

CIDER - an alcoholic beverage from apples.

PERRY - an alcoholic beverage from pears.

CALVADOS - an alcoholic beverage from apples, apple brandy.

POMACE - solid remains of fruits after pressing for juice, it contains skins, pulp, seeds.

ORCHARD - system of planting trees, that is maintained for food production.

Cider develops a sweeter taste when stored in chestnut barrels.

Capacity	Height	Diameter at centre	Diameter at end
30L	55cm	35cm	25cm
50L	64cm	45cm	33cm
100L	81cm	48cm	41cm

M9
Very dwarfing - Reaches a height of 8 to 10 ft (2.4 to 3.0 m), coming into fruit after 3–4 years, reaching full capacity of 50 to 65 pounds (23 to 29 kg) after 5 to 6 years. It will grow under average soil conditions, but needs a good rich soil to thrive. A good choice where space is limited and fertility is high. Permanent staking is required, as is routine feeding and watering. Trees on this rootstock always require leader support. The rootstock is very susceptible to fire blight and can develop burr knots.

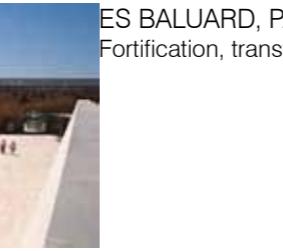
M26
A good choice of rootstock for a small garden, more vigorous than M9, it will withstand moderate competition from weeds and grass and will grow successfully in soils with fertility on the low side.
M26 rootstock trees do not produce a strong root system and they should therefore be supported by a stake during their lives. It is ideal for the amateur gardener who wants to grow a small bush tree or cordon and espalier shaped trees. Its size can be controlled to a large degree by pruning twice a year, with no specialist knowledge required.

M27

A very dwarfing rootstock. Unless the central leader is supported, the tree will be very small. Often only used as an intermediate stem piece on MM.106 or MM.111. If handled and spaced properly, it can be a very productive stock for a vertical axe system. Trees can be grown three to four feet tall and produce about 45 fruit, roughly 2 pecks, depending on fruit cultivar.

M106
A good choice for small to large gardens. This rootstock will produce an apple tree about 3.6 metres (12 foot) wide and 3m (10 foot) tall at maturity. Apple trees on M106 rootstock can easily be pruned to keep them to a height of around 2 to 2.5 metres (6 to 8 ft) high. They have the added benefit over M26 rootstock in that they will not require staking after a couple of years. The roots are reasonably vigorous and an M106 rootstock apple tree can easily support itself without the need for staking. It will produce about 23 kilo (50lb) fruit in a normal season.

REF [H]



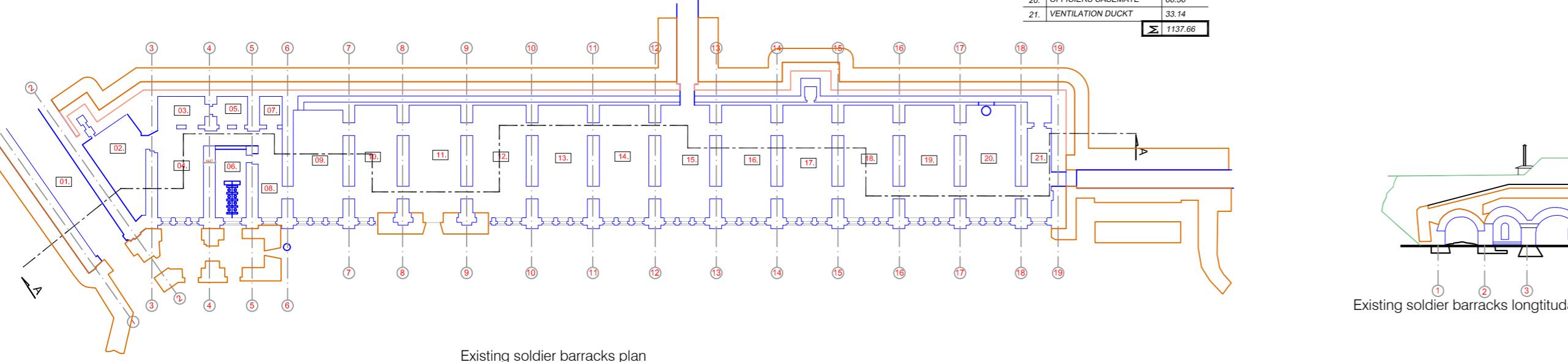
REF [I]



4. DESIGN

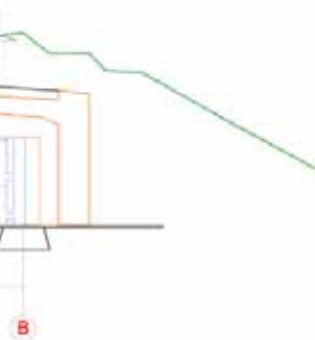
4.01 FORT SCALE

I chose to develop one part of the fort- barracks. I want to investigate how I can adapt the existing structure for new uses.



BARRACKS EXPLICATION

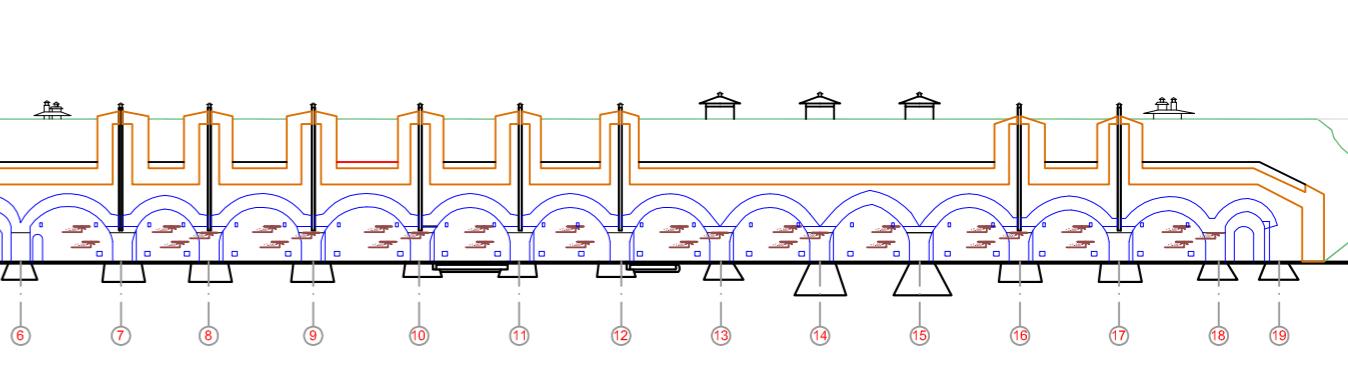
Nr.	Space	area, m ²
01.	POSTERN	71.45
02.	?	35.31
03.	LARDER	15.14
04.	KITCHEN	52.95
05.	LARDER	10.19
06.	LAVATORY	26.58
07.	?	77.77
08.	?	20.35
09.	BARRACKS CASEMATES	66.01
10.	BARRACKS CASEMATES	66.47
11.	BARRACKS CASEMATES	66.12
12.	BARRACKS CASEMATES	66.31
13.	BARRACKS CASEMATES	66.23
14.	BARRACKS CASEMATES	66.53
15.	BARRACKS CASEMATES	65.96
16.	BARRACKS CASEMATES	66.35
17.	BARRACKS CASEMATES	65.98
18.	COMMANDANTS CASEMATE	66.09
19.		66.37
20.	OFFICERS CASEMATE	66.36
21.	VENTILATION DUCT	33.14
		Σ 1137.66



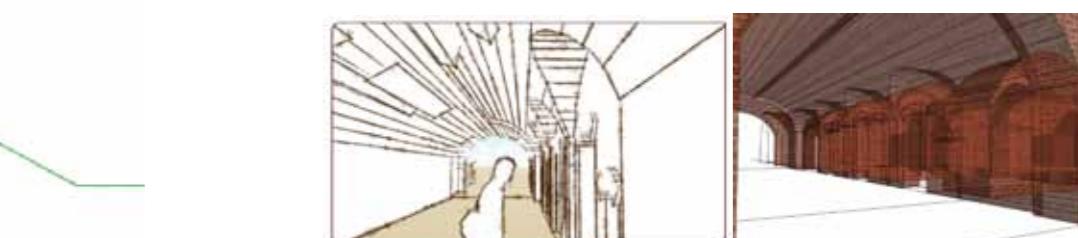
Existing soldier barracks cross section



Existing soldier barracks

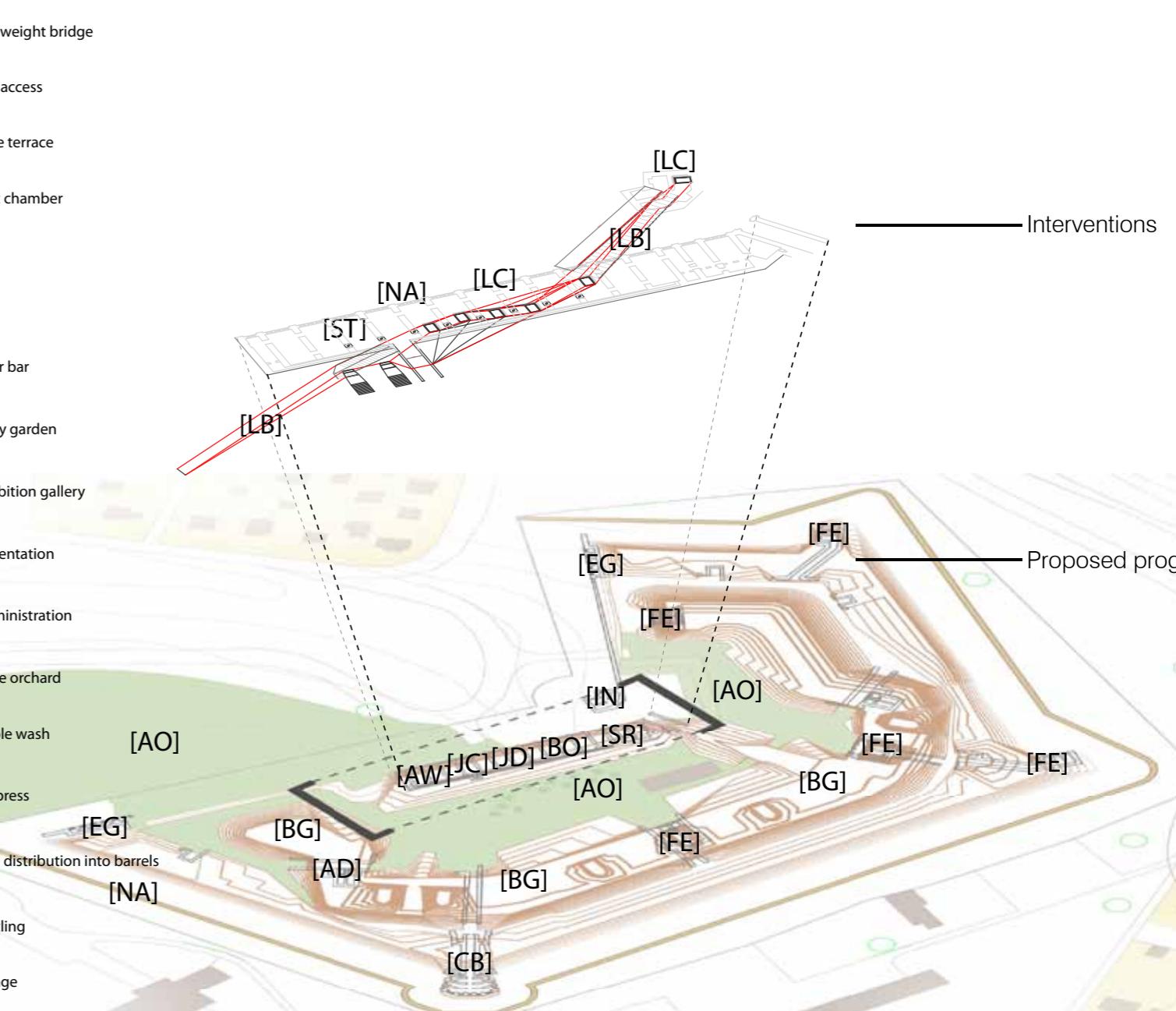
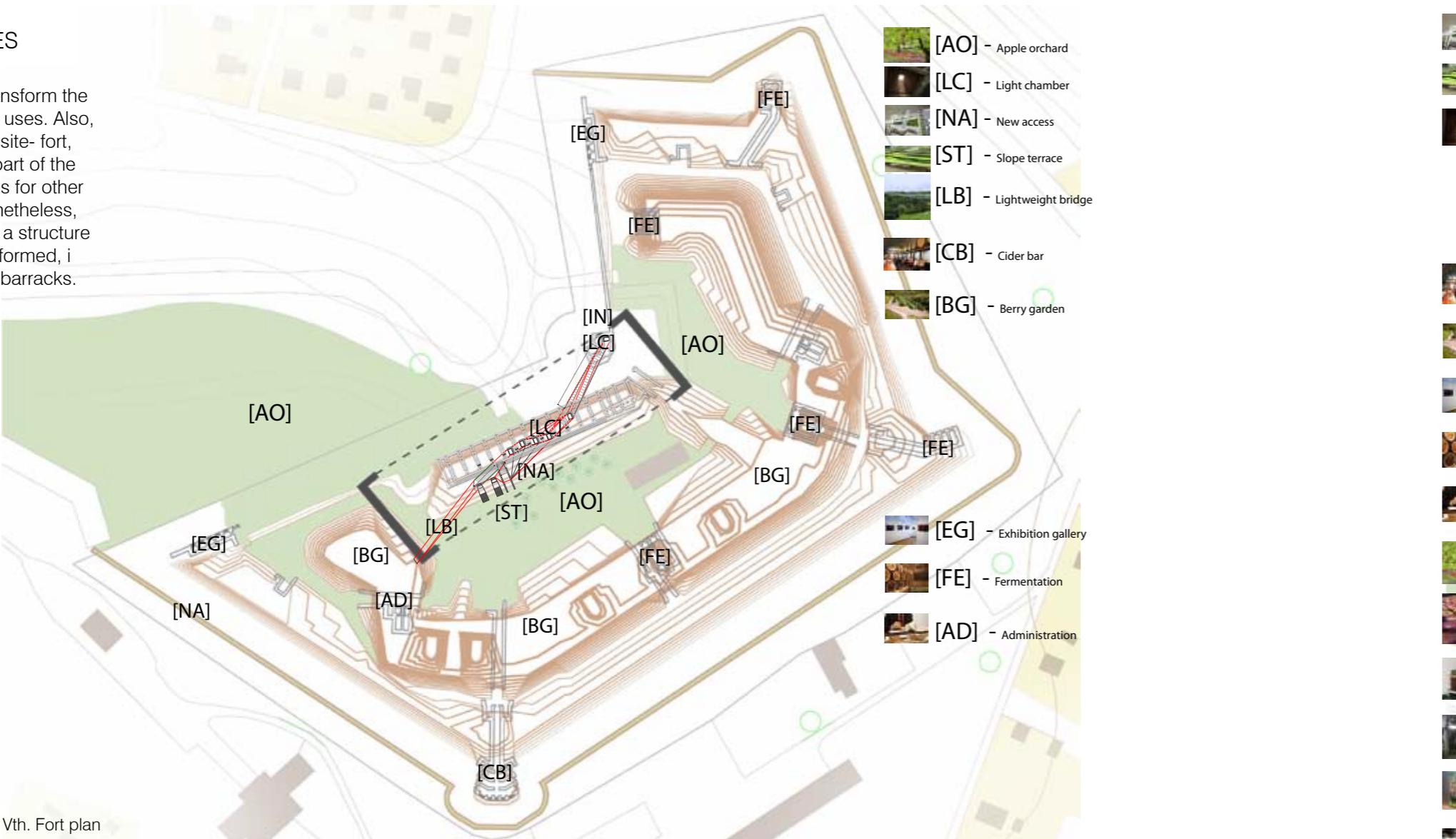


Existing soldier barracks longitudinal section



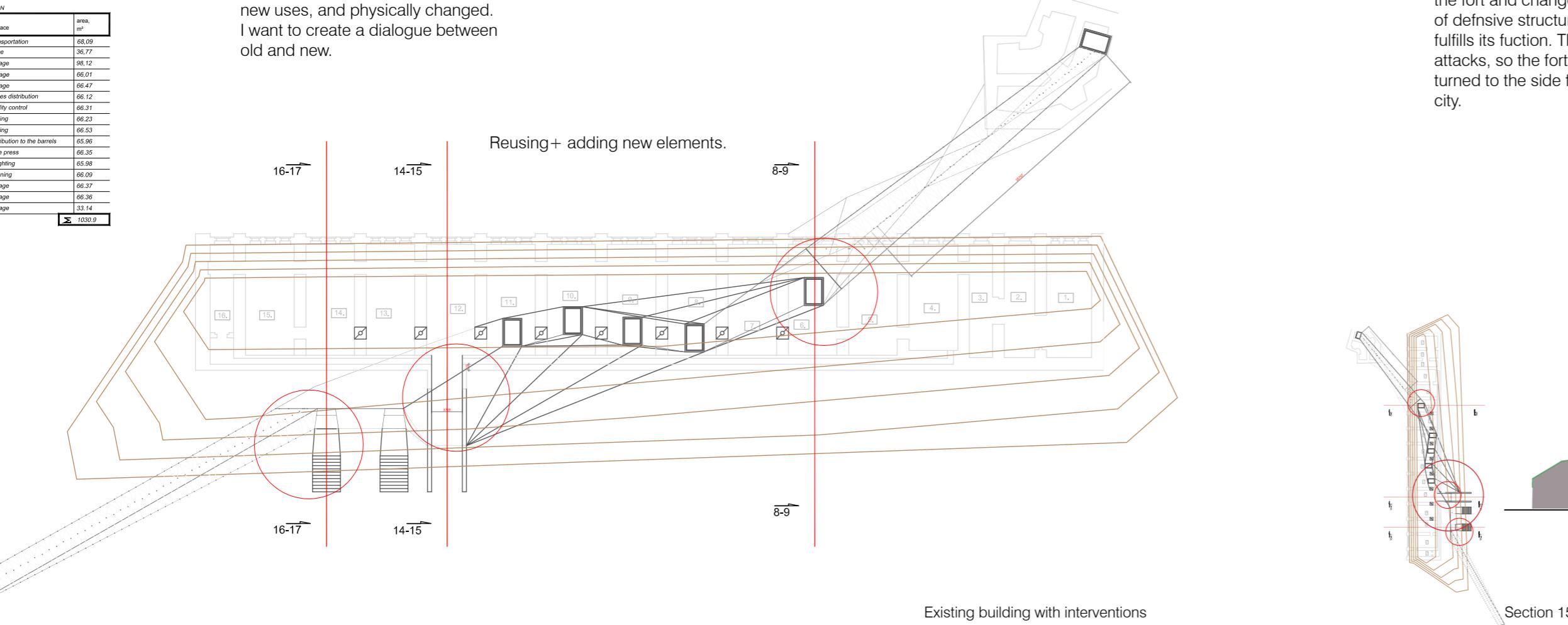
PROPOSED PROGRAMMES

I proposed to transform the existing barracks for new uses. Also, a plan for how the whole site- fort, could be used. Another part of the proposal are programmes for other structures of the fort. Nonetheless, to investigate closer how a structure physically could be transformed, i decided to work with the barracks.



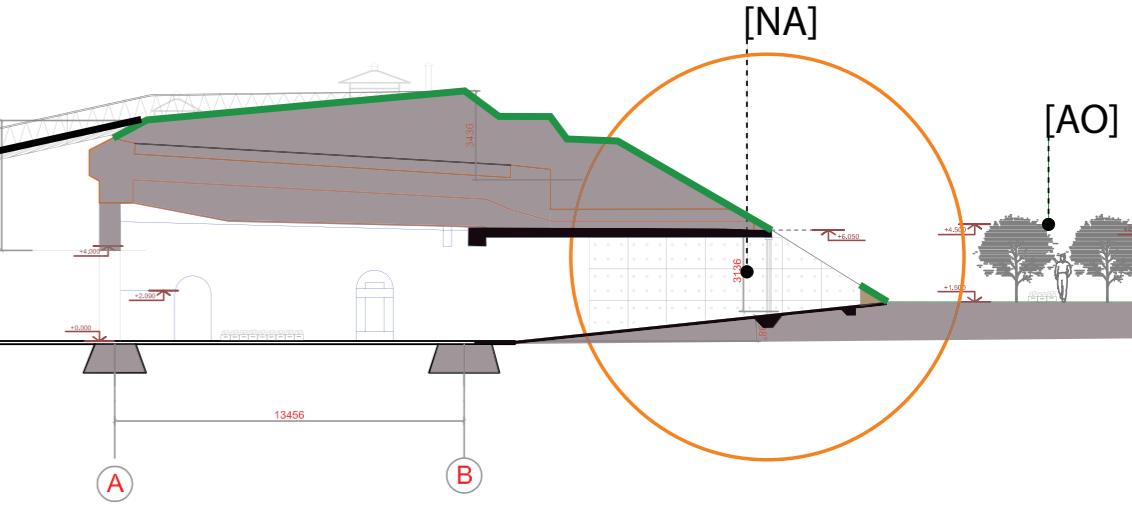
My proposal investigates how the structure can be adapted to new uses, and physically changed. I want to create a dialogue between old and new.

EXPLICATION		
Nr.	Space	area, m ²
01.	Transportation	68,09
02.	Office	36,77
03.	Storage	98,12
04.	Storage	66,01
05.	Storage	66,47
06.	Bottles distribution	66,12
07.	Quality control	66,31
08.	Bottling	66,23
09.	Bottling	66,53
10.	Distribution to the barrels	65,96
11.	Juice press	66,35
12.	Weighting	65,98
13.	Cleaning	66,09
14.	Storage	66,37
15.	Storage	66,36
16.	Storage	33,14
		Σ 1030,9



The idea is to bring life into the fort and change the perception of defensive structure which no longer fulfills its function. There are no enemy attacks, so the fort could be partially turned to the side facing former outer city.

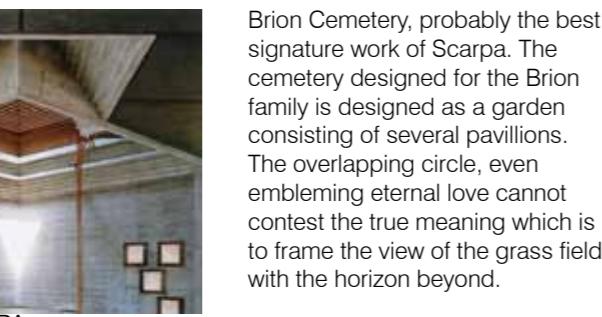
Workers could easier access the facilities without need of going around the building, since the whole structure is facing the opposite side. This intervention would allow easier movement for storing the apples from the orchard to the storage rooms. When not needed it would have a gate to close down, that would hold the relief original shape.



INTERVENTIONS: LIGHT CHAMBER

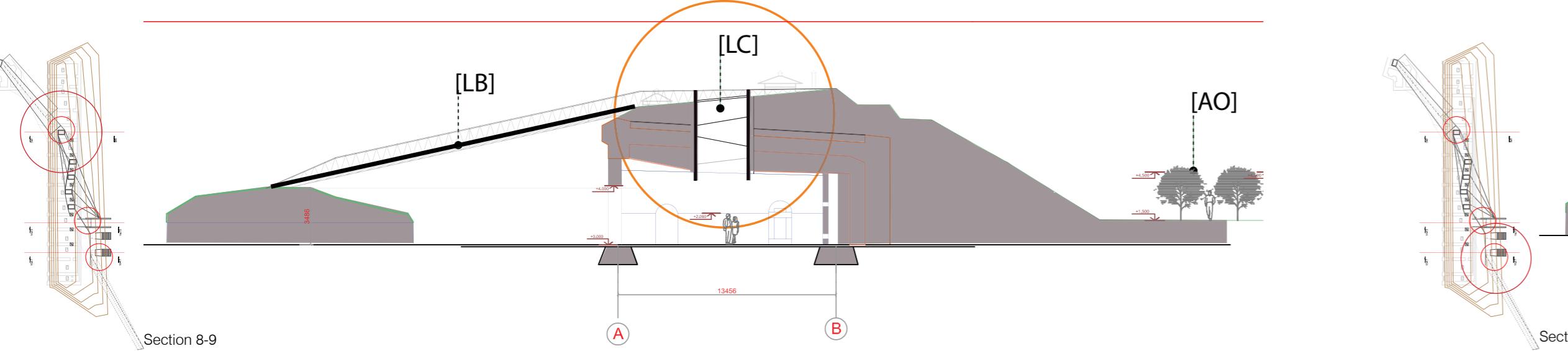
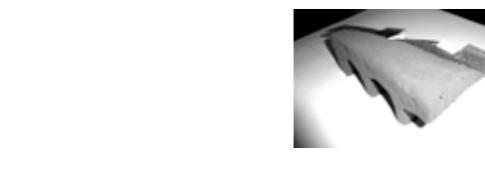
This type of intervention would let the light into the existing structure. Before, the barracks were built to protect the soldiers, so they did not have so much light in the structure. The defence reasons were dictating the spatial qualities, the structures were designed to withstand the enemy hits.

REF [J]



CARLOS SCARPA,
BRION CEMETERY

Brion Cemetery, probably the best signature work of Scarpa. The cemetery designed for the Brion family is designed as a garden consisting of several pavilions. The overlapping circle, even embleming eternal love cannot contest the true meaning which is to frame the view of the grass field with the horizon beyond.



INTERVENTIONS: SLOPE TERRACE

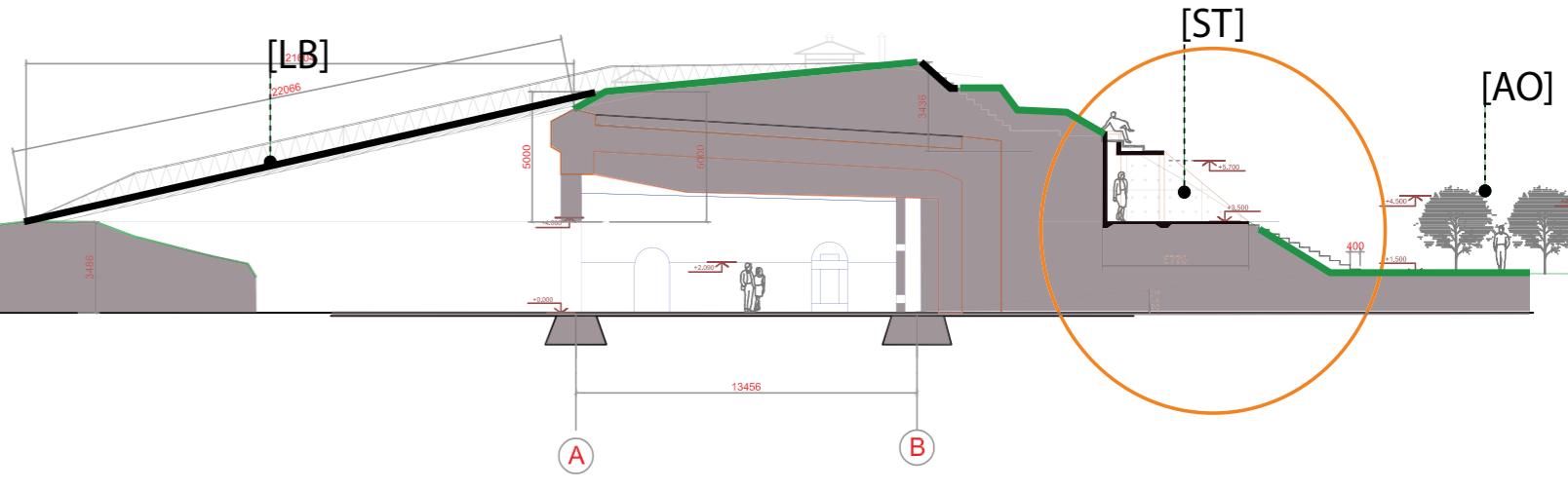
This type of intervention would allow the visitors to enjoy their time in the fort, to have a picnic, to enjoy the scenery of an orchard and blossoming apple trees. The terrace is a part of the whole lightweight spine, it is a part of the route. The terrace is not destroying the original relief, but adding some qualities to it.

REF [K]



WIROA STATION WINERY

The building is a simple viewing platform, and wine tasting room for the use of residents of a small beach side development in the far north of New Zealand. Restricted to 25m² due to local planning regulations, and set in to the hill side to reduce the presence on the skyline, this simple building forms a calm backdrop to the scenery, intended to enhance the enjoyment of the environment, and wine tasting.



BIBLIOGRAPHY

PRINT

- Nijole Steponaitė "Kraštovaizdžio pritaikymas ir pertvarkymas statant Kauno tvirtove", Urbanistika ir Architektura 2006, XXX tomas, Nr.4
- Kestutis Zaleckis and Nijole Steponaitė "Kauno tvirtoves gynybiniu statiniu urbanistinis potencialas", Urbanistika ir Architektura 2009
- Nijole Steponaitė "Buvusios Kauno tvirtoves 1,2,3,4,5,6,7,8,9 fortu ir Linkuvos itvirtinimo zeldiniu ivertinimas bei issaugojimo ir tvarkymo siulymai", Kaunas 1996
- Paul Virilio "Bunker Archeology" Princeton Architectural press
- Vladimir Orlov "The atlas of Kaunas fortress", Kaunas 2009
- Vladimir Orlov "Kauno tvirtoves istorija", Kaunas 2007
- Ed. Inaki Abalos "Campos de betalla", Coac publications 2005
- Nijole Steponaitė "Kraštovaizdžio pritaikymas ir pertvarkymas statant Kauno tvirtove", Urbanistika ir Architektura 2006, XXX tomas, Nr.4
- Kestutis Zaleckis and Nijole Steponaitė "Kauno tvirtoves gynybiniu statiniu urbanistinis potencialas", Urbanistika ir Architektura 2009
- Mark Crinson "Urban Memory: History and amnesia in the modern city", New York 2005

INTERNET

- <http://public.fotki.com/lzrd/kauno-fortai-1/>
- http://lt.wikipedia.org/wiki/Kauno_tvirtov%C4%97
- <http://tvirtove.kaunas.lt/istorija/next.htm>
- <http://urbex.lt/objekta/fortai-itvirtinimai/>
- http://www.balticfortroute.eu/index.php?option=com_content&task=blogcategory&id=15&Itemid=36
- <http://db1.stat.gov.lt/statbank/selectvarval/saveselections.asp?MainTable=M3020104&PLanguage=0&TableStyle=&Buttons=&PXSlId=6284&IQY=&TC=&ST=ST&rvar0=&rvar1=&rvar2=&rvar3=&rvar4=&rvar5=&rvar6=&rvar7=&rvar8=&rvar9=&rvar10=&rvar11=&rvar12=&rvar13=&rvar14=>
- <http://www.bikely.com/maps/bike-path/Kauno-fortai>
- <http://www.way2lithuania.com/en/travel-lithuania/kaunas-fortress>
- <http://www.karopaveldas.lt/>
- http://datos.kvb.lt/index.php?option=com_laikotarpiai&task=view&id=21&Itemid=67&extend=335
- http://knyga.kvb.lt/index.php?option=com_content&task=view&id=170&Itemid=104
- <http://1914-1918.invisionzone.com/forums/index.php?showtopic=141891>
- <http://maps.kaunas.lt/bendrojo-plano-zemelapis>
- <http://www.laisvalaikiodovanos.lt/dovana/isgyvenimo-drama-sovietiniame-bunkeryje-2asmenims>
- http://www.convertiblecity.de/projekte_projekt34.html
- <http://www.rietveldlandscape.com/en/projects/7>