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SUMMARY FOR PUBLIC INSPECTION

STUDY OF ENVIRONMENTAL IMPACT ESTIMATION

ZADAR PORT FERRY TERMINAL

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1. INTRODUCTION

The existing Zadar ferry port is an international port and one of the most important state passenger port on the Adriatic and it is also significant as a connection between Croatian, Italian and other Mediterranean ports. It is also important as a connection between ports and ferry ports in Croatian coastline and between coastline and hinterlans. It aslo has the important role for developinf tourism as one of the most important industrial acticvity.

Conceptual design of Zadar Ferry port has been done on the basis of Physical-traffic study "Zadar ferry port" in 1996 and Urban planning in 2000. The key characteristic of study and plan is locating a new ferry port in Gaženica.

Reasons for ferry traffic relocation from old town centre to a new location are numerous: physical, functional, historical, cultural and sociological (servicing ferry traffic without adequate passenger infrastructure, berthing manipulation and servicing ship traffic in narrow and inadequate quay area, a chaotic vehicular traffic in summer months, ecological pollution by exhaust gasses, noise, blocking a pedestrian passageway during servicing international lines, multiple degradation of cultural and historical centre – the representative focus of the town).

This decision primarily produce: division of ferry and ship lines transporting road vehicles from fast passenger lines, reducing a large number of vehicles from old town centre, creating large quay areas for recepting passenger boats and attractive ambient for pedestrians and tourists in old town centre, reduction of noise and air pollution at the Peninsula, quality connecting of the islands, port on the coast and overseas ports with Zadar and hinterland.

Direct effects are so great that new terminal can be referred to as a strategic element of transforming the whole town. Relocation of ferry port to a new location will generate deep changes in traffic and physical sense for the town.

- Relocation of ferry port produce pre-conditions for significant turn toward the town development. From continental toward lithoral. Ferry terminal will start processes of increasing urban permeability toward coastline.
- New location will influence the changes of urban network in regional and local level as well as the level of separate elements of urban structure. Section Jazine – Bregdetti valley is recognized as the area of a great potential and together with new port focus it will reaffirmate a lithoral development of urban network. In that context ferry terminal becomes the final point of new urbanism of Zadar as a Mediterranean port town and powerful place of its lithoral identity.
- New ferry terminal will stimulate urban reconstruction and requalification of the area (infrastructural rehabilitation, physical and functional reinterpretation, removal of minor structures) within future town port-ferry zone and wider.
- At a new location of ferry port and Bregdetti valley a new port urban structure will be cerated which will stimulate further development or restructuring of lithoral industry and form a strong focus of town, district and state industrial development.
- In a traffic sense a construction of a new ferry port terminal together with the penetration of motorway to a port area reffers to final forming Zadar terminal into one of the most significant Adriatic traffic intersections.

2. DESCRIPTION OF INTERVENTION AND LOCATION

2.1. PURPOSE OF INTERVENTION

2.1.1. ORGANIZATION OF FERRY TERMINAL

Suggested organization of future Zadar Ferry Terminal determines the following facts:

- Ferry port represents sea exit and entrance to the Town and thus has a special experiental value which should be reflected to planning of port area as well as to architectural shaping
- Port is a place of powerful urban potential, intersection of different types of traffic as as such it is attractor for numerous other activities (complementary and non-complementary). Port area will gain additional liveleness and stronger urban character by planning such activities.
- Port is the Town's exit to the sea and also a point from which the Town heads toward the land. In that sense the suggested physical organization should enable the interference of the Town (future surrounding construction) with port area. Port area itself is characterized as an area of attraction, hanging around as well as it provides undisturbed traffic load and unload.

The above mentioned provides the basic physical-functional concept of Zadar Ferry Terminal which has been developed simultaneously with traffic solution and quay-maritime solution. It can be roughly divided in two parts: north-western for domestic traffic and south-western and south-eastern for international traffic.

Part of terminal for domestic traffic is turned toward fishermen port, fish market, hotel and they all together would form a lively town part. In that way a picturesque character and "commotion" characteristic for old town port would be transferred to area of the future port. This part of terminal represents the end of town coast area approachable to pedestrians (it is followed by international part under a rigid regime and container terminal). In wider perspective, this composition of fishermen port and part of terminal for domestic traffic confirms already stated – port becomes a significant place of lithoral identity of the Town – and also a new urban processes commenced by finalizing this project will occur.

Part of terminal for international traffic, similar as for air traffic, is subordinated to rigid principles of passengers and vehicles flow. Since the quay area has been planned for vehicular traffic only, due to controlled regimes in international traffic, this part of port will have somehow different character in relation to part for domestic traffic. The coastline itself is designed in a way to strictly separate these two types of traffic and their possible interference if necessary.
Beside separation in domestic and international part, physical organization is defined by two more elements: port superstructure and external surfaces.

Port superstructure consists of terminal facility which provides necessary passenger's service together with commercial centre and aboveground pedestrian promenade. Beside physical existence in newly risen surrounding, commercial centre is important as a possible model of construction co-financing or maintaining the basic corpus of this architectural ensemble – terminal facility. The importance of pedestrian promenade is also twofold: beside functional justifiability of connecting commercial centre and terminal facility in a stage separated from vehicular traffic, promenade is an area that is custom-made for an individual, a pedestrian vis-à-vis technicistic surrounding in mega criterion.

External areas stand for public, open (horticulturaly arranged) areas. Those are spaces of interference of terminal and its future surrounding. This interaction of port and town will finally produce liveliness and energy characteristic for Mediterranean town.

Land part of terminal is organized in accordance with stated division and needs of vehicular traffic so areas reserved for repose traffic are dominant in the port: waiting lounge in island terminal and waiting lounges in international traffic – waiting for border control and lines prior to boat boarding.

Beside repose traffic in terminal area all port vehicular traffic is solved by using frontage road from which different directions are sorted (island terminal, international terminal, terminal facility). Roads (edged by tall vegetation) separate particular physical-functional zones, underlining basic urbanistic organization.

Port entrances are planned at two points:

- One for international
- One for domestic traffic (and public transport vehicles).

Exits are planned at three points:

- One for international
- One for domestic traffic
- One for public transport vehicles

2.1.2. NEW PORT AREAS-MARINE EMBANKMENTS

In order to organize new port activity at new location it will be necessary to primarily create new areas. Mitigating circumstance in this activity is shallow sea.
New areas necessary for terminal functioning would be gained by filling depths from –2,0 to –12,5m. Summarizing all three terminals approx. 1.300,00 m3 of pure stone material of certain granulation would be necessary.

2.1.3. NEW QUAYS IN FERRY MARITIME ZONE

After filling is completed and necessary depths in lines of future quays are gained, the edge of the embankment will be arranged by construction of quays. It is planned to construct all quays in maritime zone as gravitational, massive, by assembly blocks.

For the choice of this type of construction the following predispositions exist:

- Maritime zone bottom is stone, with small sludge-sandy cover, not thicker than 80 cm. That means it is suitable for foundation of quay structures of massive-gravitational type.
- Depths of the sea and quays are not large except in international passenger terminal which also enables construction of gravitational quays.
- All previously mentioned enables precast construction of massive quay wall by pre-fabricated elements-blocks which significantly reduces construction duration and mitigates phase construction.
- Quay loadings are not significantly limited and significant loading approximations are possible (specail cargos and similar) if necessary.
- Infrastructure installation conducted in these quays is much simpler and cheaper particularly taking into consideration the fact that is is intensively used quay area and quay edge.
- Construction of these quays is cheaper than construction of divided concrete structures and it can be completely performed by home construction companies.

2.1.4. PORT PROTECTION-BREAKWATER

For the purpose of protecting maritime zone of a new port it will be necessary to construct breakwaters. For secondary breakwater (western) it is estimated to use approx. 130.000,00 m3 of filling matrial of different granulations (core, filter and armour layer). All these embankments would be done by filling frontally by trucks and arranging the embankment edge by buldozers.

Since maritime zone bottom is stony (very thin layer of sand and sludge) no larger embankment settling than filling moment settling is expected. That means that embankments can be arranged and used for teminal purposes right after filling.

2.1.5. STRUCTURES

TERMINAL FACILITY

The position of terminal facility as well as its longitudinal organization is determined by position of two elevated footbridges for reception and release of passengers in international traffic. Basic functions of facility – reception of passengers in arrival and departure and border control activities – are placed in ground floor. In that process passengers in ferry traffic and passengers in cruising traffic are divided.

Beside the above mentioned basic functions, facility of international terminal will contain offices for different services: shipping agency, customs office, police office, port authority office, etc. which will be placed in entresol and the first floor. Offices will end in a tower on whose top a navigation centre will be placed.
In access area and entrance hall areas for service (and other) activities are planned: ticket sale, exchange offices, traveller's and tourist agencies, internet services, restaurants, caffes, rent-a-car agencies, shops and other which will provide certain dynamics even in a period of reduced intensity of port traffic.
All these activities have autonomy in approach and utilization, each part in particular and are open for changes dependant on future, new demands.

ELEVATED PEDESTRIAN PROMENADE

Elevated pedestrian promenade with catering establishments, shaded terraces, autochthonous vegetation is a place with Mediterranean ambient planned as counter-poise to the rest of port used for traffic areas and cars. Stratification of directions in two levels enables penetration of pedestrians deep into port area. Ground floor and upper floor are connected by strong stairs and escalators at three points: at the ends and at joint with covered terminal square. The upper level line end in a belvedere with a view to exciting port activities and commotions.

COMMERCIAL CENTRE WITH MULTI-STOREY PARKING LOT

Commercial centre with multi-storey parking lot together with thematic parks will form the front of terminal toward the town. It is planned as one of construction stages and combination of parking lot with business premises will have a positive financial effect to port business transaction.
Parking space with 3 controlled entrances/exits is planned for parking of centre's employees and long-term parking of passengers. In case a parking capacity is not sufficient it is possible to produce additional parking spaces on the roof.
Facades toward streets are formed by offices and central commercial area is a zone of combined premises (offices, catering establishments, entertainment, service companies...). This hybrid functional model will act as a strong marketing attractor fro investors and users.
Under changed circumstances (which are impossible to be predicted at the moment because of time distance) a changes in relation to hereby suggested disposition would be possible.

EXTERNAL AREAS

Positioning a parking space in terminal facility basement and multi-storey parking lot areas whose role is twofold has been gained. Greening and horticultural arrangement will humanize terminal area leaded with heavy traffic and create a physical identity of port.
At entrance/exit point of international terminal a thematic park "Eternal Zadar" will be constructed and at the entrance to the port from the town a thematic park "1000 islands". Those are public spaces that take as a theme multi-millenarean history (but also present and futue) of Zadar and natural and cultural uniqueness of Croatian coast. Those will make the first impression of arriving passengers, attract passerbys to port area, form spaces of sojourn

oppositely to continous movement around them. These areas will get more definite features in design elaboration.

The roof of basement parking lot will be constructed as a park whose topography will be determined by heights of the space below (higher technical spaces vis-à-vis lower parking lot). Park will be tree-lined by autochthonous (Mediterranean) tree species, (not overgrown with grass) floor surfaces will be performed by stone combined with concrete pavement.

Waiting-room areas (international and domestic traffic) will also be tree-lined as much as possible. Trees-aslo autochthonous species: stone pines, palm trees and other- planted in 3-4 rows will create a shade in waiting-room areas of domestic and international terminals during summer heats.

2.2. DATA FROM PHYSICAL PLANNING DOCUMENTS

Planned intervention relates to construction of new Zadar ferry port (ferry terminal) in Gaženica which belongs to Zadar Port. Since planned intervention and analysed area are complex of republic importance all documents of physical planning valid for this area have been analysed Those are:

1. STRATEGY AND PROGRAMME OF PHYSICAL PLANNING OF THE REPUBLIC OF CROATIA
2. PHYSICAL PLANNING OF ZADAR DISTRICT (PPŽ)
3. PHYSICAL PLANNING OF THE TOWN OF ZADAR (PPUG)
4. GENERAL URBAN PLANNING OF THE TOWN OF ZADAR (GUP)
5. URBAN PLANNING OF ZADAR FERRY TERMINAL (UPU)

1. STRATEGY AND PROGRAMME OF PHYSICAL PLANNING OF THE REPUBLIC OF CROATIA

(Ministry of physical planning, construction and habitation, Directorate for physical planning, 1999, O.G. 50/99). Zadar port has a very important role for tourism development as one of the most important and vital industrial branch. Therefore its importance in planning of infrastructural, traffic system as well as in industrial point of view is emphasized in Strategy and programme of physical planning of the Republic of Croatia adopted in Parliament in May, 1999 (O.G. 50/99.).

2. PHYSICAL PLANNING OF ZADAR DISTRICT (PPŽ) (Directorate for physical planning of Zadar district, Zadar, 2005). Physical planning of Zadar district determines that new Zadar ferry port (ferry terminal) will be constructed in Gaženica. area. The existing Zadar passenger port will also remain. Both ports still keep the status of international ports important for the Republic of Croatia. Thus, it can be concluded that planned intervention, in other words construction of new Zadar Ferry port in Gaženica is in accordance with Physical planning of Zadar district.

3. PHYSICAL PLANNING OF THE TOWN OF ZADAR (PPUG) (Directorate for physical planning of Zadar district, Zadar, 2004(Zadar Gazette 4/04)). Physicall planning of the town of Zadar hase been done together with Physical planning of Zadar district. Since these two physical planning documents (PPUG i PPŽ) are compliant, planned development in the town area is compliant with Strategy and Programme of physical planning of the Republic of Croatia, but primarily with determined goals and assignments of social-economical development of Zadar.

4. GENERAL URBAN PLANNING OF THE TOWN OF ZADAR (GUP) ("ACES" Ltd. Zadar, 2000)

General urban planning of the town of Zadar defines the territory and maritime zone designed for passenger and cargo traffic. Also a territory designed for industrial programmes in the hinterland of port area is also defined. Planned intervention, in other words construction of Zadar Ferry Terminal in Gaženica is in accordance with General Urban Planning of the town of Zadar.

5. URBAN PLANNING OF ZADAR FERRY TERMINAL (UPU)

("Marinaprojekt" Ltd Zadar and Directorate for physical planning, Zadar, 2000 (Zadar Gazette 7/00)). For the first time in physical planning documentation the location of new ferry terminal is stated, planned by GUP in 1972, and it is affirmated again in GUP of 1992 after twenty years of trying to find the more suitable location. Area of the intervention is divided in two units : business park zone and port zone. The existing infrastructural equipment within intervention zone is not satisfactory for planned activities and it is necessary to reconstruct the existing and construct a new traffic, energetic, telecommunication and water supply networks. The area within plan intervention is approx. 155 ha and is divided in two zones.

Planned intervention, in other words construction of Zadar Ferry Terminal in Gaženica, which is a part of Zadar port is in accordance with urban planning of Zadar Ferry Terminal.

2.3. DESCRIPTION OF LOCATION SURROUNDING AND INTERVENTION IMPACT AREA

Area of future location of ferry terminal occupies western part of industrial zone of Zadar. Torrential creek Ričina which flows into Brodan rift divides the future port zone in two separate segments. In area by the Bregdetti valley mostly storage and service plants are placed while in area south from Gaženica road by Brodan rift mostly industrial structures are placed. North-western from confluence of Ričina creek Arbanasi marine is placed in location where smaller vessels and fishing boats anchor. Bathing resort Kolovare stretches from Bajlo Cape to old town centre.

Development of industrial zone in Gaženica area and construction of port plants created port focus whose development occupies area from Arbanasi to Bibinje. Nowadays this area with industrial zone is called Gaženica port and it is in nature the entity that means Zadar trade port.

On the eastern part of that area a centre of trade port is situated and western side is less used (toward Arbanasi) since a natural obstacle of shallow sea exists (5-6m), so marines and quays used by companies positioned in that part of industrial zone developed there.

As already stated, a part of port plants in Gaženica port has already been constructed. The most important facilities are: quay for reshipment of liquid cargos, quay for reshipment of general and bulk cargos and quay for general purposes. All these structures are rather packed, very close to each other without any interspace, dependant on ship and cargo size.

2.4. DESCRIPTION OF INTERVENTION

2.4.1. FUNCTION OF PLANNED INTERVENTION

Terminals of maritime traffic form separate or connected sub-units dependant on level of autonomy or complementarity.
The highest level of physical, traffic and technological uniqueness is characteristic for island ferry terminal - IFT, while terminal of along-coast line navigation – TACN and International terminal - IT work as a complemenary sub-system.
For all terminals a principle of physical separation from public road system was used. In terminal zone a traffic is included by a system one one-way arrangement with clearly marked directions. In accordance with physical possibilities and traffic frequency a separation of terminal entrance and exit has been done.
In front of each terminal points for reception of individual and public transport are located:

- bus station of public town transport
- taxi station
- temporary bus parking lot for busses waiting for passengers - tourists
- temporary parking zone for seeing off and waiting of passengers
- long-term parking zone for people leaving their vehicles on land or for those who can do it on a large universal pre-terminal parking lot (busses, cargo vehicles, personal vehicles) or in multi-storey parking lot.

In zones TACN and IT pedestrian traffic is separated by level from vehiculat traffic stage and is in progress on the above ground level pedestrian passageways.

Within the zone of each terminal general rules of traffic regulation are applied and they guarantee the following:

- assuring the fast and safe approach from public traffic system to ship ramp and vice versa
- selecting traffic according to destinations
- selecting traffic according to types of traffic means
- selecting domesting and foreign traffic
- separating vehicles from lines without blocking traffic flow
- systematic marking and informing traffic participants
- consistent one-way traffic regulation
- all traffic and manipulation zones are open for changing regime or for new organization demands
- open service approach for intervention vehicles (fire, ambulance, police) to all zones is enabled.

The key term for all open areas of marine terminals of ferry port, as well as for structural development of facility is flexibility. Beside flexibility of physical structure it is necessary to realize predispositions for functional ambiguity of particular elements. Thus an easy adjustment of functions to often unpredictable situations is guaranteed and the whole system will be pliant for accepting a new organitation – technological demands in future.

2.4.2. PHYSICAL DEMANDS OF PLANNED INTERVENTION

Newly arranged Zadar ferry terminal will occupy the area of totally 237 200 m^2 (24 ha) on the land and 321 300 m^2 (32 ha) on the sea, in other words sum-total of 558 500 m^2 (56 ha).

1. BASIC SURFACES STATEMENT

I.) PORT OPERATIONAL SURFACES

1. IFT	12.500,00 m^2
2. TACN and IT	13.500,00 m^2
3. RL	13.300,00 m^2
	39.300,00 m^2

II.) QUAYS WITH BACKQUAY SURFACE

1. IFT	11.300,00 m^2
2. TACN	13.000,00 m^2
3. IT	19.900,00 m^2
4. RL	8.500,00 m^2
	52.700,00 m^2

III.) FACILITIES AND INFRASTRUCTURE

1. TERMINAL FACILITY WITH BASEMENT PARKING LOT (surface 16 000 m^2)	41.438,00 m^2
2. BASEMENT PARKING LOT	11.997,00 m^2
3. SKYWAYS	2.455,00 m^2
4. COMMERCIAL CENTRE WITH MULTI-STOREY PARKING LOT (surface 7 800 m^2)	24.209,00 m^2
5. PARKING SPACES	8.287,00 m^2
(surface 46 540 m^2)	**88.386,00 m^2**

IV.) ROADS AND INFRASTRUCTURE OBJECTS (BREAKWATERS)	**98.660,00 m^2**
TOTAL TERMINAL AREA	**237.200,00 m^2**
MARITIME ZONE	**321.300,00 m^2**
TOTAL	558.500,00 m^2

2.4.3 STRUCTURE CONSTRUCTION METHOD

DESCRIPTION OF TERMINAL PLATEAU

Terminal plateau can be divided in two physically separated port plateaus:

- fishermen port plateau which occupies area of approx. 2,18 ha
- terminal plateau in area of 16,34 ha.

Mutual connection with hinterland the ferry terminal realises by a new road of high cathegory from the existing Biograd road to new road under construction Zadar 2 Gaženica (main port road) and new road of importance for the country to motorway on Zadar 2 intersection.

A) FISHERMEN PORT PLATEAU

Fishermen port plateau is located in a central part of new maritime zone, bounded from the west by the existing quay and planned hotel complex at Ričina estuary and from east by a new terminal. During that the existing coastline is preserved and it can be used during works

are in progress. From the sea side the entrance to maritime zone approx. 100 m wide is planned which is described in details in maritime elaborate. Plateau enables the reception of 20 fishing boats and on a quay part a possible organization of fish market and gas stationfor fishermen's needs.

Plateau dimensions are following:

- plateau surface 2,18 ha
- lenght on the land part: 370m
- lenght on a quay part-stairlike construction: 204 + 85 + 30m of existing quay
- plateau width – dependant on stairlike organization 68, 52 or 8 m of existing quay

B) FERRY TERMINAL PLATEAU

Ferry terminal plateau occupies the area of 16,3 ha (total area with jetties) and is located by the existing Gaženica cargo port from western side. In layout disposition it is located south from new transversal port road (axis MC00) which enables the link of Zadar centre with new road Gaženica - Zadar 2 (under construction). Plateau location is situated completely on maritime domain, necessary surfaces and depths of quay are designed by quay filling till the depth of approx. 12 to 15m.

General characteristics of plateau:

Total surface of plateau is :	16,340 ha
- surface of island terminal	30.500 m^2
- surface of international and cruiser terminal – part by a quay	51.600 m^2
- surface of facility with shed (terrain surface)	16.530 m^2
- waiting-room of international terminal	10.800 m^2
- elevated passageway	1.054 m^2
- park over underground parking lot	8.400 m^2
- commercial facility with multi-storey parking lot (terrain surface)	8.650 m^2
- thematic par “1000 islands” and “Eternal Zadar”	10.370 m^2
- internal roads	14.266 m^2
- other surfaces (pedestrian)	11.238 m^2

Terminal for domestic island traffic (island ferry terminal IFT) is organized in the westernmost part, turned toward fishermen marine and future hotel and together they will form a lively town centre. Smaller boats are therefore berthed in protected maritime zone. Island terminal is technologically organized as a separate entity. Approach to terminal is possible via circular junction and internal terminal road or from Zadar centre. Waiting area is provided in terminal with 490 parking spaces. Vehicles are sorted in lines dependant on destination. Simultaneous boarding to ferry and unboarding from adjacent ferry is always enabled. This disturbes one-way movement on island terminal but it enables vehicles circulation and flow. Waiting area is divided in two mutually separated parts for the purpose of easier traffic organization.

Terminal of along-coast navigation and international terminal is located in the central part of terminal, mutualy connected with cruiser terminal (police customs). Waiting area is divided in two parts. At the entrance from roundabout and via internal road vehicles are driven to pre-customs waiting area so not only quay area is loaded. Pre-customs waiting area can accept approx. 450 vehicles, in other words equivalent number of cargo vehicles. After passing through customs office, vehicles are driven to quay tracks which can accept approx. 450 cars. During vehicles unboarding from ferries they pass through customs office by longitudinal internal road and are joining traffic flow at a roundabout also by internal road.

Internal roads enable traffic flow in terminal. Road grid is regular, roads are parallel and vertical considering the coastline. Flow is mostly one-way. Roads are three-tracked trotračne, 3x3,5m wide, where one line is used as intervention line in case of accidents. Their longitudinal fall is obligatory 0,5 %, transversal fall 2,5%. Typical concrete curbs 15X25, MB 30 placed in concrete separate them from pedestrian and green areas. In all pedestrian crossing curbs must be flushed in minimum lenght of 1 m, with max. Elevation of

1cm from pavement dimension with location slope. During that it is necessary to form a ramp of different colour and texture from surrounding area on that pedestrian corridor.

All radiuses of right turners are such to enable turning for cargo vehicles – mostly are 11 m.

During treatment of vehicular area a flexible pavement structure is planned whose exact composition will be determined during design processing and possible new demands.

All roads and waiting areas should be equipped with vertical and horizontal traffic signalization according to valid regulations and dynamic signalization related to traffic technology. For the purpose of traffic organization a traffic centre is planned whose video supervision and automatic system will conduct land traffic in port. Traffic centre is situated in a part of navigation tower.

C) DESCRIPTION OF ACCESS ROADS

It is necessary to construct accesss roads so that terminal can function. For undisturbed functioning it is necessary to construct the following roads:

1. state road roundabout – Zadar 2 intersection
2. longitudinal port road – connection Bibinje road – roundabout
3. part of intersection for entrance in cargo port in order to enable undisturbed functioning of cargo port and the major part of energetic installations and other infrastructure would be lead through it.

The most important road is state road which connects ferry port with motorway in Zadar 2 intersection. It is already under construction. Road is of high cathegory, four-tracked with median. Through the part of industrial zone a viaduct passes that is lowered to the ground approx. 80 m from ferry port. An intersection is planned at that point which would represent the future junction for entrance – exit of cargo port.

Access road ends in a roundabout with two tracks. Internal radius of roundabout is ¸18.5m, and external radius has a diameter of 30m. Roundabout has three approaches, it is positioned centrally to access road from the motorway, longitudinal port road and internal entrance road to ferry port. Greening arrangement with adequate public lighting is planned within the roundabout.

Longitudinal port road – Bibinje road – roundabout, total lenght is 1+312.95m. It is planned as high cathegory road, four-tracked road, two tracks in each direction separated by median 1.50 m wide. Planned calculation speed is 80 km/h. Tracks are 2x3,25m wide, with marginal strip of 0.25m. Road is lit by public lighting, with 0,5% longitudinal fall alternately in order to achieve the possibility of longitudinal drainage, with transversal single slope of 2,5 %. By system ofr perforated curbs precipitation water is collected in pipeline and thus lead to separator and further into recipient.

Road is planned in stone material embankment which should be performed in layers whose thickness is dependant on compression machines in precisely elaborated technology. Filling is done in the existing sea surface and part of that should be filled is out of intervention zone. Since Ričina creek flows into sea in chainage of approx. 0+530 it is necessary to perform plate culverts – sloped bridge in axis 10 m long. In that part Ričina creek should be chanelled and arranged. Channel will be performed by the edge of fishermen port.

On the road bus lay-bys are planned in a zone of five to ten minutes walk, dependant on interest groups.

Road is equipped with traffic signalization, vertical and horizontal and dynamic signalization dependant on terminal traffic condition.
Dependant on overcoming architectural barriers measures such as those for internal terminal roads are planned.

It is necessary to horticulturaly arrange the area around traffic areas.

PERFORMANCE OF QUAY CONSTRUCTIONS AND GENERAL STONE EMBANKMENTS

NEW PORT AREAS – MARINE EMBANKMENTS

In order to organize new port activity in location it is primarily necessary to create new areas. Extenuating circumstance in this effort is shallow sea, especially in location of fishermen port and island terminal. Those are averagely sea depths of 2,0 m' and max 5,0 m'.

In the location of along-coast navigation terminal and international passenger terminal the situation is similar. New areas necessary for functioning of terminal would be gained by filling of the sea, in this case significantly deeper. Depths here range from -2,0 to -12,5 m. Including all three terminals it would be necessary approx. 1.300.000 m3 of pure stone material of particular granulation with max 5% of earth portion for new terminal embankments.

There are two possibilities of purchasing stone material for embankments:

- from registered quarry in Zadar neighbourhood with valid licence for stone exploitation
- from extra selected stone material which is disposed by Zagreb – Split motorway

For the purposes of new port maritime zone protection it is necessary to construct new breakwaters. For secondary breakwater (western) it is estimated to use approx. 130.000 m3 of embankment from material of different granulations (core, filter and armour layer).
All these embankments would be performed by frontal filling by trucks or embankment edge arrangement by buldozers.
Since maritime zone bottom is stony (very thin layer of sand and sludge) no larger embankment settling than filling moment settling is expected. More precisely it means that embankments can be arranged and used for teminal purposes right after filling.

Picture 1. Map of excavation, embankment, quay and jetty lengths in Zadar ferry port

NEW QUAYS IN FERRY PORT MARITIME ZONE

After filling is finished and necessary depth is gained in lines of future quays, the embankments edge will be arranged by quay construction. It is planned that all quays in maritime zone will be constructed as gravitational, massive from precast concrete blocks.

For the choice of this type of construction the following predispositions exist:

- Firstly, maritime zone bottom is stony, with small sludge-sandy cover, not thicker than 80 cm. That means it is suitable for foundation of quay structures of massive-gravitational type.
- Secondly, depths of the sea and quays are not large except in international passenger terminal which also enables construction of gravitational quays.
- Thirdly, all previously mentioned enables precast construction of massive quay wall by pre-fabricated elements-blocks which significantly reduces construction duration and mitigates phase construction.
- Fourthly, quay loadings are not significantly limited and significant loading approximations are possible (specail cargos and similar) if necessary.

- Fiftly, infrastructure installation conducted in these quays is much simpler and cheaper particularly taking into consideration the fact that is is intensively used quay area and quay edge.
- Sixtly, construction of these quays is cheaper than construction of divided concrete structures and it can be completely performed by home construction companies.

Picture 1a. Profile 1-1

Picture 1b. Profile 2-2

Picture 1c. Profile 3-3

Picture 1d. Profile 4-4

JETTY CONSTRUCTIONS AND PARTS OF QUAY ON PILES

In places where it is necessary to provide the sea flow for circulation and on terminal jetties a divided reinforced concrete structure with vertical and slope piles, assembly abutements and cassette plates will be performed. Assembly elements are connected into unit by concrete implemented in site.

Basic grid of structure load bearing elements, in other words piles is 9,90 x 9,90 m'. Piles are ϕ 1.800 mm. They are conducted through general stone embankment, layer of dusty sand and end min 3,0 m' in limestone. Assembly prestressed cassette plates sized 9,90 x 9,90 x 1,44 m' are set on piles and assembly prestressed beams on quay border. Beams function as breakwater. The whole quay structure is expanded into five fields. Dimension of the largest field is 71,30 x 131,95 m'. Each field has sloped steel piles ϕ 812,8 mm, wall thickness S=20 mm, which transfer horizontal forces to span structures on the ground. Tops of piles end in limestone.

QUAY EQUIPPMENT

For safe ship berthing quay is equipped with rubber fenders and load bearing pollers. Fenders are fixed to quay through galvanised locks. Sea entrance and exit is provided through steel sailor's stairs which are implemented in assembly elements of quay structure. Structure expansion are protected with steel locks. Two container bridges will be installed on quay. For that purpose a crane paths with fenders will be made. For cargo manipulation on quay a mobile port cranes are planned.

CONSTRUCTION SITE ORGANIZATION

In accordance with construction stages and realisation dynamics of particular stage it is necessary to provide approx. 20.000 m² area for construction site organization. That area will be gained by demolition of existing worn out and inadequate port storages in backcoast area.
Those areas are already equipped with complete infrastructure.

CONSTRUCTION STAGE

Considering the size of construction multi-stage performance is planned. According to conclusions from meetings with Investor's representatives a two-stage construction is determined. Each stage can be divided into smaller steps which represent technological unit in usage and in construction.

First stage plannes construction of marine structures:

- STEP 1. Filling of quays and areas behind intervention area
- STEP 2. Construction of all maritime structures and coastline
- STEP 3. Arrangement of all terminal areas to dimension +2.40mnm
  With necessary infrastructure
- STEP 4. Construction of breakwater on Bajlo Cape
- STEP 5. Construction of access longitudinal road Bibinje road - roundabout

Second stage stands for addition of constructed marine areas, in other words terminaql facility and arrangement of ferry terminal till its full designed functionality. Performance is planned in four steps :

- STEP 1. Construction of terminal facility with all functions and part of underground garage
- STEP 2. Construction of the second part of underground garage with arranging green area in park
- STEP 3. Construction of skyways
- STEP 4. Construction of commercial centre with multi-storey parking lot

2.4.3.1. TRAFFIC SOLUTION OF ZADAR FERRY PORT - LAND

Specific quality of Zadar ferry port in wider sense is the fact that it incorporates different types of traffic: local, along-coast and international as well as cruising travels.

As a result of elements in the above mentioned chapter and presented specific qualities a basic physical-functional concept of Zadar ferry port derives which can be roughly divided in two parts: nort-western part for domestic traffic and south-western and south-eastern part for international traffic. Coastline is designed so that no strict division in these two types of traffic exists but it enables its interference if needed.

Connection of port and road network is realised through the main intersection located at the end of joint road Zadar 2 -Gaženica and main port road (in layouts marked as intersection D). Intersection is defines as circular intersection with two tracks and it represents entrance-exit intersection for international port and port's link to system of state roads.

Insertion of frontage road from which different movement directions are sorted (international terminal, terminal facility, island terminal) provides traffic distribution towards designed destinations.

Entrance to port for domestic traffic from centre of town is realised through intersection «B» by right turn after which a traffic is sorted toward island terminal, terminal facility or covered parking lot in basement of terminal facility.

Exit from domestic port is realised through intersection «A», by left turn for direction toward town or by right turn toward the motorway. Exit for public transport vehicles in front of terminal facility and vehicles parked in covered parking lot is provided in intersection «C».

Joint road Zadar 2- Gaženica is interpolated in port area through circular intersection and entrance to cargo port is relocated approx. 100 m norther than the intersection defined by Urban planning toward arterial road where interchange is inserted which connects cargo port with state road network.

A regime of one-way traffic flow is applied within terminal, except in a part of quay terminal where two-way return for supply vehicles is enabled. This solution reduces the number of contact points to possible minimum.

Terminal is connected to public town transport network (PTT), and this connection is realised by bus entrance through intersection »B» and arrival to covered square from which passengers go toward terminal facility and destination jetties. This is also a station for reception of passengers coming from boats. If need be a transport of passengers to and from jetties will be organized by internal transport within port.

Spaces for placing busses for transport of organized passenger groups, taxis as well as spaces for temporary parking during transport of passengers with escort (max 15 min) are provided in front of terminal facility.

PARKING SPACES IN TERMINAL

By analysing the existing condition, traffic rise trends as well as data of planned long-term traffic rise a traffic prognosis has been made which produced a sufficient number of parking spaces toward destinations.

Since the needs of vehicular traffic, especially of vehicles waiting for boarding are very significant areas reserved for repose traffic dominate in port area.

According to division of port to areas for domestic and international traffic a division of waiting area has also been made.

For waiting area of domestic island terminal 490 parking spaces have been provided for vehicles waiting for boarding. It is necessary to point out the complementarity of those waiting areas which can be used as multi-purpose for island lines and along-coast lines dependant on necessity and intensity of demand at that moment.

At pre-customs waiting area of international traffic an area with 450 parking spaces is provided. From that area vehicles go to passages for customs control and further to boarding after information and call.

Since the process of customs control latst for some time and in order to ensure the area for stationing vehicles which passed control in their departure and are waiting for boarding waiting areas are provided for those vehicles. Those areas, dependant on demand will be used as waiting areas for boarding to or from ship as waiting areas for customs control. Dependant on organization those areas can accept approx. 450 vehicles. Organization and direction of vehicles during boarding in and out should be such to provide unambiguous traffic regulation. A special area for vehicles going through detailed customs control after boarding in and out is provided, so called „red zone“ with provided space for 90 cargo vehicles. This solution requires minimum possible berthing of ship for the purpose of boarding in and out.

For the purpose of parking terminal users as well as passengers whose travel continues by boat 535 parking spaces in terminal facility basement are provided. Entrance to covered parking lot is realised thorugh intersection «B» and service road and exit is realised through intersection «C».

In commercial centre with multi-storey parking lot 438 parking spaces are provided. Contruction of this structure which will form terminal front is planned as the last stage of construction and combined with business premises it will positively financially influence business transaction of port. In the first stage the unconstructed area would be used for parking space and successively with traffic rise in port a garage structures would be constructed.

2.4.3.2. MUNICIPAL INFRASTRUCTURE

2.4.3.2.1. WATER SUPPLY

The existing water supply of Gaženica port-industrial zone together with water supply system of Zadar Ferry Terminal (ZFT) is not satisfactory since it has not been constructed by design. Due to lack of unique general concept, structures were connected to water supply system in the simplest and the cheapest way possible at that moment.
The existing water supply system is realised from different directions which fulfills the momentary demand for water of this are but to achieve some systematic solution it is necessary to create a relevant design.
A material from which this water supply system is constructed of is different so cast iron, steel, galvanized, plastic and asbestoscement pipes of different profiles have been implemented. The existing cas iron pipeline is of 125 mm profile, asbestoscement pipeline of 250 mm profile along the railway tracks (from north-east) and asbestoscement pipeline of 300 mm profile with one remaining section of old cast iron pipeline. Longer or shorter joints are of galvanized pipes. Recently, a water supply pipeline of 700 mm profile (transferred to 500 mm) has been constructed on Adriatic tourist road.

This design will present a proposal of solution for water supply system of intervention zone of ZFT but with overview to whole industrial zone. In other words, industrial zone starts by the arterial road and stretches south-western in stylized quadrangle. Supply pipelines must pass through the edge of whole industrial zone in order to reach ZFT which is situated at the bottom of that quadrangle.
Surfaces of the above mentioned zones are (including the sea part):

- industrial zone is approx. 155 ha
- ZFT intervention zone is approx. 44,3 ha (16, 36 ha of that is quay part)

This data is presented here in order to show the differences in expected quantities. Therefore, the major supply pipelines are dimensioned for demands of whole industrial zone. But there are no specific data on type and demand of future industrial consumers and that for calculation the planned number of employed staff in industrial zone and their supply norm will be used.

According to Urban planning of ZFT a water supply system of whole industrial zone is performed by combining of the existing and planned pipelines. In this design profiles and routes from Urban planning of ZFT were used with two exceptions:

- planned supply profile 300 mm remains the same (it is not reduced to 150 mm) in a route of the main port road because of larger port demands in relation to those known in the time of Urban planning creation
- the reconstruction of the existing profile DN 250 in a length of 200 m is planned for a joint of the main water supply pipeline DN 300 mm from eastern side

Main water supply is performed thrpugh two planned pipelines which start from joint on arterial road to the existing water supply pipeline of 700 mm and 500 profiles and than continue through border roads of industrial zone and spread ringlike in a water supply network throughout the whole plateau following roads routes.
Hydrants are placed at specified 80 m in populated areas, including jetties for ship berthing so the hydrant network covers the whole area. Above ground level hydrants are planned, placed in green areas on pavements at specified distances where they will not disturb anything and in the centre of jetties where future columns – girders for skyways will be positioned so they do not disturb the passage of supply vehicles.
Water supply pipes are ductile for pressure pipelines NP 10 bars, ISO 2531 and DIN 28600 protected by cement mortar from inside and zinc and bitumen from outside. They are placed in pavement with overlay of 70 cm so that crossing with other installations is enabled (especially precipitation collector of large dimensions).

Supply of ships will be performed by specialized compartments in which joints for water with adjoining measuring device will be placed. It is recommended that all supply compartments

are connected by a system of remote control into one dispatch centre situated in a basement of terminal facility.

2.4.3.2.2. DRAINAGE

The existing sewage network in Gaženica port-industrial zone is not systematically constructed. It is mostly a partial solving of a separate structure with the simplest solution. Each collector separately drains waste waters to the sea in the shortest way. All waste waters are discharged into sea without purification so near the discharge outlets of separate collectors the sea water is already polluted in aesthetic, sanitary-hygienic and ecollogical sense. Coastal sea is especially polluted in Ričina estuary in Brodan rift valley where anaerobic conditions already dominate.

Drainage in Gaženica port-industrial zone is planned as division system. In that process waste waters are divided into:
- sanitary consumable waters (faecal)
- technological waste waters
- precipitation waste waters are separated into:
- precipitation waters from roads
- precipitation waters from parking lots and garages.

Division of waste waters is the reason why separate sewage systems exist.

Faecal waters are collected into separate sewage system and drained to treatment plant. On both sides of ZFT border are two pumping sewage stations:
- south-easter is PS Gaženica II (Q_c = 244,0 l/s), for ZFT area 23 l/s are planned
- norht-western is PS Gaženica I (Q_c = 388,0 l/s)

Within specified ZFT zone one pumping station PS Terminal is planned which collects faecal waters from terminal facility and other adjoining structures (detached public toilet facility, customs office facility and border police office) and transports them into pumping station PS Gaženica II by pressure conduit DN 100 mm.
PS Terminal – calculated max water consumption for 11 500 passengers: $Q_{max\ passengers}$= 4,9 l/s

Waste water is calculated as 80 % of consumption:
Q_{uk}= 80 % Q = 3,5 l/s
Δh = 3,5 m

Pressure conduit from PS Terminal toward PS Gaženica II is of ductile pipe DN 100 mm.
If ZFT is constructed before public sewage system which includes pumping stations and kilometres of collectors is finished it is possible to place a temporary local faecal waters treatment plant with purification level that could enable a temporary discharge of treated waters into port sea by quay discharge outlet with obligatory construction of designed sewage infrastructure.

Technologic waters must be internaly treated within separate plants to the level which enables a discharge into a faecal sewage system. For that purpose a control sewage shaft must exist in a public area so that waste water can be undisturbedly controlled at any time.
Precipitation waters are divided in waste waters from roads and waste waters from parking lots and garages.
The above mentioned differ in method of treatment of those waters before discharge into a public system.

Precipitation waters from roads must pass through sedimenting system which is achieved by implementation of sinkhole with settling basin. Implementation of a large settling basin in outlet collector before discharging into coastline zone is not possible in quay borderline because outlets are under sea level. Profiles of precipitation sewage are according to Urban planning of ZFT from 500 mm to 2200 mm., and as a material for pipes a ribbed PEHD and swelded PEHD is used, and for profile 2200 mm a polymerconcrete elements. Level line falls are from 2‰ to 20‰. Falls are so small due to almost flat ground and effort to bury large profiled precipitation collectors under sea level as little as possible.

Oily precipitation eaters from parking lots and garages are treated in 4 separators S1, S2, S3, S4 situated in a way not to disturb traffic and reachable to treatment and maintenance vehicles. Chosen separators are classic reinforced-concrete ones, made from concrete resistant to sea water impact with necessary application of adequate coatings because of probable penetration of sea water due to sea proximity and relatively low dimensions (approx +2,4 m n.m.). Equipment must be inoxa resistant to sea water.

Waste waters from ships are collected into «faecal» trucks and taken away to treatment plant in a specific location. Transport of waste water from ships is done through specific openings in a ship to which a flexible pipe from «faecal» truck is attached.

2.4.3.2.3. ELECTRIC-POWER INSTALLATIONS

- **Work zone «GAŽENICA» within which Zadar Ferry Terminal is situated** is supplied from the existing transformer station TS TS – ZADAR-4 35/10kV with double unclosed 20kV ring, through 20kV cable XHE 49-A 3x(1x185/25mm2).
  In future when the reconstruction of the existing TS ZADAR 110/35kV to 110/20kV is done and new 20kV cable is palced to TS «VINARIJA», and the reconstruction of TS ZADAR-4 35/10 in a new 20kV switch is done, the whole zone will be supplied from TS ZADAR 110/20kV.

- **For purposes of Zadar Ferry Terminal supply** a bricked transformer station 3x1000kVA, 10(20)/0,4kV, is planned which will be connected to the existing 20kV ring by 20kV cables XHE 49-A 3x(1x185/25mm^2) in TS «TVORNICA DUHANA» or TS «ELEKTRONIKA».
  New transformer station will include the following separate areas:

  - three transformer chambers for reception of transformer power of 1000kVA,
  - room for placing middle-voltage 20 kV plant
  - room for placing low-voltage 0,4kV plant

  Truck approach will be provided to transformer station.
  In low-voltage plant the main switchboard will be placed with measuring points of netwotk consumers, devices for automatic compensation and main switchboard of aggregate consumers.
  All commercial facilities will be supplied from the main switchboard with own calculation measuring point.
- **For the purpose of all consumers' supply a low-voltage network will be performed** with usage of typical cables such as PPOO-A 4x150mm^2, which will end in cable switchboard compartments implemented in structures.

- **According to architectural-urban, traffic and horticultural solution a public lighting will be performed**, with maximum avoiding a light pollution.
  Road lighting will be solved in accordance with light technical demands according to road classification.
  Cu rope 50mm^2 will be placed as a ground.
  Cables will be placed partially in earth trench and partially by drawing in adequate PVC pipes.
  Parallel conduit and crossing of cables will be performed according to specified mutual distances and additional protections.

TELEPHONE INSTALLATION

Zadar Ferry Terminal is situated at the edge of Zadar in Gaženica. In that part there is a telecommunication network that gravitate to remote subscriber's level (TRL) Gaženica, digital switchboard AXE 10 Zadar 1. TC network is partially performedby a direct placing of cables into ground and other part is performed through cable pipeline.

Ferry terminal is not covered by cable pipeline so it must be performed from refferent-switch point «A». It is also the closest TC network well, of cable 6 which could connect terminal to TRL Gaženica and it is approx. 500 m distant from planned structures.
In cables near Ferry terminal there are not enough reserve pairs which would fulfill demands of this complex.

It is necessary to perform a part of cable pipeline from the existing well „A" to the complex in accordance with the existing PUP Gaženica. Further within Ferry terminal area a cable pipeline should also be performed to key points of future installations concentration.
The capacity of ingoing TC pipeline should be: pipes 2XPEHDø75 + 2XPEHDø50mm with assembly wells, type D2 (internal dimensions: 90x100x73 cm).
Cable connection should be done by pulling in a new TC cable from TRL Gaženica through the existing pipeline to point „A", further through new pipeline to separate cable outlets.
Outlet locations are determined by installation concentration of a separate structure so that 4 key points are planned: 1 in commercial centre, 1 terminal facility-left, 1 terminal facility-right (near the navigation tower), and one cable outlet at border control.
Since by all of the above mentioned points 2 pipes will be placed, of 75 and 50 mm diameter, the possibility of pulling in a subscriber's TC cable will be enabled and if necessary «blowing in» a light-transmitting cable.
A detailed elaboration of TC cable capacity will be presented in a Design of switching.
Telephone installations of a each separate structure should end in switch compartments and cables should be type: TC 3 POHFEFR.

ENERGY POWER SUPPLY

Supply of heating and cooling energy is solved by central energy plant where central heating and cooling plants should be placed..

HEATING PLANT

- hot-water heating plant is designed for system of hot water 110/70 ^{0}C.
- Heating plant fuel is extra light EL.
- Fuel should be stored in a season tank of a capacity for 30-40 days.
- the possibility of gas plant is also planned which would be used in a second stage when gas network is performed.
- Heating plant fulfills the Regulation of technical norms for designing, construction and maintenance of gas heating plants beside other rules and standards
- torches that use liquid and gas fuel should be chosen.
- optimal number of heating plant units should be chosen and special attention should be paid to elasticity of plant and construction stages.

COOLING PLANT

For the purpose of cooling of construction cooling devices performed as heat raising water-water are planned which could be used for heating in transition periods.
Heat raising will use the sea in close proximity as energy source which is of stabile temperatures.
It is necessary to select two or three devices to enable construction in stages and elastic and safe plant. Cooling means R 407 C is selected for heat raising.
Heat alteration between sea water and heat raising (evaporator or condenser) is solved with tile heat alterators which should be resistant to sea impact.

Temperature levels of heat raising work:
- winter 50/40 ^{0}C
- summer 7/12 ^{0}C

Heat tank of adequate capacity is planned in a system for balanced compressor work.
Sea water intervention will be performed in a location with the minimum possible pollution.
Sea water recovery after "utilization" will be performed in a location where short-circuit with suction can be avoided.

HEATING SUBSTATIONS

Considering the size of a construction a heating substations are planned in suitable locations and distance from area in which they are connected to heating and cooling systems. All reinforcement and equipment for heating, cooling and air-conditioning should be situated in heating substations.

VENTILATION AND AIR-CONDITIONING

Dependant on purpose and size of particular areas for air-conditioning process the air low-pressure one-chanelled systems and ventilation convector systems (fan-coil) are selected.
Separate air-conditioning systems are planned for separate areas, paying attention to consumers and working and utilization regimes. Chamber air-condition should be situated in a separate room close to separate areas in order to reduce channel distributors.
If possible part of chambers for separate areas should be situated on the roof of construction.
In air-conditioned areas a pre-pressure is planned in order to prevent the penetration of outer air through the door or other areas.
At the entrance door to rooms where great communication of people is occur the air curtains which protect air-conditioned areas from negative outer influences are planned.
The elements for air distribution should be arranged in a way to fulfill technical terms and physical planning terms.
A special attention should be paid to location of suction of fresh air and locations of exhausting waste air considering they are separated enough to avoid mixing.
Waste air must be conducted to the roof of the construction.
To save energy the solutions which enable the utilization of waste air heat will be used.

While designing the air systems the fire protection was considered and the solution was adjusted to fire protection elaborate. In all locations where channels pass from one fire sector to the other it is necessary to implement the adequate fire protection flaps.
For smaller areas and offices a system of ventilation convectors is planned for filling a transmission losses and gaining heat and ventilation system for providing the necessary quantity of fresh air.
Za fan-coils a double-barrelled distribution system is planned with the possibility of switching from winter to summer regime and vice versa.
Fan-coils should be vertically implemented on the floor or in lowered ceiling as a cassette, dependant on interior arrangement.
Toilet facilities ventilation is performed by forced exhaust of waste air. The number of alterations is determined according to valid standards.
Storage areas with no possibility of natural ventilation should be ventilated by forced exhaust of air indirectly with waste air from air-conditioned areas.
It is planned that all rooms in which any action polluting the air is performed are forcely ventilated.
A special attention is paid to basement or ground level garage ventilation problem. System is performed in accordance with norms. Ventilation is solved by forced supply and exhaust of polluted air. Its quantity is determined according to number of motor vehicles and MAC (maximum allowed concentrate) of carbon monoxide CO, according to VDI 2053.
CO plant for measurement, regulation and alarming is planned.

MATERIALS AND EQUIPMENT

- During the selection of heating, cooling, ventilation and air-conditioning system the attention has been paid to choice of such materials and equiment that are adequate for the planned purpose by its quality and characteristics.
- It is planned to perform pipelines from steel seamless pipes.

- Heating insulation of all heat transferring pipelines is planned.
- Pipes and reinforcements of cool water should be thermally insulated with adequate insulation.
- Tin channels for air-conditioned air distribution should be made of galvanized tin thick according to standards
- Pressure and recovery chanells should be thermally insulated and soundproof in adequate thickness.

CENTRAL SYSTEM OF SUPERVISION AND MANAGEMENT

A microprocession systems of regulation and management are planned which should produce the most rational utilization of all actions of heating, cooling, ventilation and air-conditioning systems during which each system should be enabled for independent action as a separate technological unit.

Planned dentral supervision system will integrate the following systems:
- heating, cooling, ventilation and air-conditioning
- Fire alarm
- Electric power distribution
- Lighting of construction
- Approach control
- Sprinkler system

3. EVALUATION OF INTERVENTION ACCEPTABILITY

3.1. ESTIMATION OF THE EXISTING LOCATION LOADING

3.1.1. SEA

According to international regulation and conventions ratificated by the Republic of Croatia (Barcelone convention on protecting marine environment and coast area of the Mediterranean and Protocol on cooperation in fighting the pollution of Mediterranean sea by oil and other damaging and hazardous substances in cases of accidents – 1976, 1996, International convention on preventing sea pollution from ships – MARPOL, London 73/78), ports open for international traffic should be equipped with plants for reception of waste and oily waters from ships.

The equipment of port for reception waste and oily waters from ships relates to the following:

- organized service (or a contract with specialized company), or company for sea purification and collecting waste from ships,
- boats for purification the sea surface (solid waste, oil, hazardous substances, algae and other),
- smaller vessels for transport of people and equipment,
- dams for pollution encircling,
- skimmers for collecting oil fro the sea surface,
- land plants for reception and treatment of collected waste from the sea,
- specialized vehicles for actions of purification and collection of pollution,
- different types of pumps,
- dispersers and adjoining equipment,
- system for information transfer.

3.1.2. ZADAR PORT LEVEL OF EQUIPMENT WITH PLANTS FOR RECEPTION OF WASTE AND OILY WATERS

Trans-shipment of mass liquid cargo and other different cargos and ship traffic make Zadar port very endangered area of Zadar channel. In this area a great hazard from all kinds of pollutions is present due to relatively small water mass and its weak alteration and the demand to preserve purity and natural beauties of this part of the Adriatic. In that sense the organized approach to the sea protection from pollution is of vital importance.

Upon the Resolution of the Meeting house of Zadar-Knin district a Headquarters of operational centre for execution of Plan for intervention at sudden sea pollution has been established in 1997.
For areas of Zadar – Knin and Lika-Senj district a boat ECO 13 (length 13.1 m) for collecting oily waters, waste oil and solid waste from ships has recently been purchased with the following equipment:fire-fighting pump, fire-fighting cannon, tank for dispersers of 100 L with adjoining disperse equipment, crane «Palifinger», tank for oily waters of 4.8 m3 and skimer for skimming oily waters. The Government of the Republic of Croatia, Dubrovnik-Neretva and Lika-Senj districts have executed a contract of providing stock-in-trade for ECO 13 boat. But still the service for preventive action and intervention in case of sea and coast pollution has not been established not the contract with specialized company has been executed.

Zadar port does not have land installations for reception and treatment of oily waters from ships. The creation of a design for reception of solid waste, bilge waters and oily waste from ships is in progress («Port Reception Facilities for Collection Ship Generated Garbage, Bilge Water & Oil Wastes») financed by Regional centre for urgent interventions in cases of pollution of Mediterranean sea - REMPEC, governed by Internationa maritime agency (IMO) and United Nations Environmental Programme (UNEP). Designer of the subject design is Environmental Protection Engineering S.A. from Greece. The purpose of this design is the creation of a concept of the reception of stated waste and waste waters from ships in the Mediterranean and in our coast too. Within this design, in September the inspection of all Croatian ports open for international traffic has been done.

3.1.3. MARINE BENTHOS

Based on results of inspection of the sea bottom along three transections, the inflow of terigen material into inspected basin is evident and it is intensively sedimented under the circumstance of reduced marine dynamics. This significantly worsen the conditions for survival of the sea bottom communities which partially explains a small number of totally recorded species.
According to condition in the initial part of transect GŽ-01 it is possible to conclude that untreated waste waters from technological process of fish processing (greasy layers in tidal zone; fish remains at the bottom) flow into inspected area. Besides, during terrain work on transect GŽ-01, nearby the inflow of waste waters of unknown origin has been noticed. Approximately 50 m from transect toward the south there is obviously a submarine outlet which has been manifested as a characteristic «belching» of surface water due to insufficient depth.

Rocky part of the initial part of transect GŽ-02, as well as enclave of solid foundation along all three transects are inhabited with few sciaphil organisms, mostly of fitrator or suspensiophagic type of nutrition.. Small depth of their appearance confirms distinct and constant inflow of suspended substance which significantly reduces the penetration of light. Finding of *Dasycladus vermicularis* algae which is sludging indicator confirms intensified sedimentation. After all, almost all surfaces, live organisms and all kinds of bottom are covered with sludge flake.

The presence of *Mytilus galloprovincialis* mussel in mediolithoral of transects Gž-01 and GŽ-02 indicate sweetened water in a surface layer. Since colonies of *Anemonia sulcata* in the initial part of transect GŽ-02 are partially very thick it is possible to assume the more significant input of organic matter into inspected area. According to that the finding of green nitrophilic algae *Ulva lactuca* is not a surprise. Because of its successful development in polluted areas a sea lettuce is considered an indicator of nutritive salts in basin. Although its origin is in a solid base, I consider that partially large bottom areas thickly covered by this algae prove organic pollution of this area. Seemingly free algae placentas demand thorough analysis but it is probably a modificated life form which normally grows and develops from detached parts of placenta under more favourable circumstances.

In biocoenology of the Mediterranean a community of marine angiosperms fields are considered a climax-stage of biocenosis of sediment bottoms. Notices parts of angiosperm field of *Cymodocea nodosa* and its features in a final part of transects GŽ-03 speak well for very degraded comunity. Sampling should be performed in a warmer part of the year when plant and therefore the whole community should be in its vegetation maximum. But, tenuity of angiosperm and all other accompanying elements of community indicate a difficult survival of current negative conditions. Therefor I think that here we speak of the last (?) remains of formerly plentiful field which used to cover a large area.

3.1.4. CULTURAL AND HISTORICAL HERITAGE

Along thewhole length and given impact area, the location of Zadar Ferry Terminal occupies the area where there are no location with significant cultural or historical heritage.

Analyses of impact and evaluation of intervention acceptability:

A. Zone of direct impact (zone A):

In a zone of a direct impact no elements with cultural or historical importance are found.

B. Zone of indirect impact (zone B):

In a zone of indirect impact there is St Clement's church. The location of this church is of cultural and historical importance.

3.2. SURVEY OF ENVIRONMENTAL IMPACT OF INTERVENTION

3.2.1. ENVIRONMENTAL IMPACT OF INTERVENTION DURING CONSTRUCTION

During Zadar Ferry Terminal construction the following negative environmental impact can be expected:

1. increase of noise level in Gaženica industrial zone due to transport vehicles and filling
2. air pollution in industrial zone due to exhaust gasses from transport vehicles and dust during performance of earth works and embankment
3. road pollution in industrial zone during transport of constructing materials
4. osea pollution in Bregdetti valley during performance of earth and other construction works in port basin
5. impact to marine hydrodynamics
6. impact to marine benthos during performance of earth and other construction works in Bregdetti valley
7. modification of utilization regime of land and sea surfaces, especially road ones in settlements and subject location
8. modification of visual outlook and landscape due to performance of earth and other construction works
9. impact to inhabitants
10. impact of sea filling, movement and spreading of “plum” of muddy sea water

3.2.2. ENVIRONMENTAL IMPACT OF INTERVENTION DURING UTILIZATION

During port utilization the following environmental impacts are expected:

1. No changes and impacts to microclimate is expected
2. Modification of ecosystem (benthos) and specific marine biomasses
3. Damaging the existing condition of marine hydrodynamics
4. Improvement of aesthetic outlook of industrial area in ZFT zone
5. Modification of sea and coastline quality
6. Increased noise level in industrial zone from increased number of vessels
7. Reduction of safety of sailing in and out the zone of Gaženica port area

3.2.3. ENVIRONMENTAL IMPACTS OF INTERVENTION IN CASE OF ECOLOGICAL ACCIDENTS

Not any greater incidents which could cause significant ecological accidents are expected.

3.2.4. ESTIMATION OF ECOLOGICAL ACCIDENT RISK

It can be concluded that occasional accidents can be expected but really rarely and for short period of time of exposure to negative impact of moderate strenght so the general risk estimation can be stated as “acceptable risk”.

4. SURVEY OF MEASURES OF ENVIRONMENTAL PROTECTION

During preparation, construction and utilization of Zadar Ferry Port it is necessary to avoid and reduce to tolerant quantity all negative environmental impacts.

4.1. MEASURES OF ENVIRONMENTAL PROTECTION DURING PREPARATION

It is necessary to implement all technical regularions which enable the application of entactments and rules of the Republic of Croatia in this design as well as international regulations and conventions that are related to sea pollution, air pollution, waste, noise and land and sea traffic safety.

All measures from this chapter should be realized prior to obtaining a construction permit.

4.1.1. MEASURES OF CULTURAL HERITAGE PROTECTION

A design of preservation of St Clement's church should be created.

4.1.2. REDUCTION OF NEGATIVE IMPACTS TO MARITIME CHARACTERISTICS AND SEA HYDRODYNAMICS

In preparation stage of realizing the construction of Zadar Ferry Port and prior to obtaining a construction permit it is necessary to organize and create the following:

4.1.2.1. MARITIME ELABORATE

- Maritime zone protection – wave disturbance in a part of Gaženica port-Zadar Ferry Terminal
- Sailing in and out of Zadar Ferry Terminal.

4.1.2.2. PRELIMINARY AND MAING DESIGN OF ZADAR FERRY TERMINAL

4.1.2.2.1. Minimum conditions for a design of permeable breakwaters:

- Along a primary breakwater it is necessary to design submarine openings at each 20 m'
- Opening surfaces must be at least 20m2 per opening

4.1.2.2.2. Minimum criterion for wave disturbance in protected maritime zone are:

- Allowed wave height at berthing site for fishing boats and island terminal is up to 50 m.
- Allowed wave height at berthing site for along-coast and international terminal is up to 70 cm.
- Allowed wave height in dual-purpose berth site of international terminal is up to 150 cm.
- Recovery period for model wave for the protection of fishermen port basin and island terminal is 20 years.
- Solutions for wave disturbance protection in maritime zone and separate berths must be such to avoid reflected waves in a basin zone.

4.1.2.2.3. Minimum conditions for designing protection structures:

- Stability of protection – armour layer should be designed for model wave of 50 years recovery period
- Breakwater – protection height should be in accordance with the existing one
- Material of protective structures should be equal to the existing one

4.1.2.2.4. New jetties for berthing ships should be designed to be:

- permeable to provide a complete sea circulation in port basin
- jetties structure should be of prestresses reinforced-concrete precast girders and plates
- jetties should lean on reinforced-concrete precast bearing columns or piles

4.1.2.2.5. All quays should be designed as reinforced-concrete precast with final quay ring beam at site.

4.1.3. DETERMINING THE IMPACT OF ENGINEERING-GEOLOGICAL FEATURES TO STABILITY OF INTERVENTION STRUCTURES

Prior to obtaining a construction permit it is necessary to perform:

- adequate additional geological researches in order to determine a safe method of foundation work
- during designing it is necessary to take into consideration a seizmic parametres.

4.1.4. REDUCTION OF NEGATIVE SEA POLLUTION IMPACT

Drainage of waste waters from the existing and planned structures within the construction of ferry terminal will be solved systematically within the construction of sewage system of the whole Gaženica port-industrial area.

Prior to obtaining a construction permit it is necessary to create the following designs:

- design of distribution sewage system for sanitary-faecal waste water, waste precipitation water from traffic and parking spaces of terminal and “pure” precipitation roof water,
- design of waste waters generated by flushing of traffic and parking spaces of terminal
- design of sanitary-faecal waters

4.1.5. ENVIRONMENTAL PROTECTION MANAGING

Within the stage of designing it is necessary to create the following elaborates:

- «Environment managing policy»
- «Survey of environmental condition»
- «Environment managing programme»

4.1.6. MEASURES OF PROTECTION FROM INFLOW OF SUSPENDED SUBSTANCES BY RIČINA TORRENTIAL CREEK

A design of Ričina creek regulation upon which a regulation is performed at present time should be supplemented according to new terms from conceptual design of Zadar Ferry Port.

4.2. MEASURES OF ENVIRONMENTAL PROTECTION DURING CONSTRUCTION

1. REDUCTION OF AIR POLLUTION

- Transport vehicles used during construction must be under constant supervision in a sense of quantity and quality of exhaust gasses all in accordance with allowed values.
- In case of transport of very dry dusty material it is necessary to water spray it.
- Filling works should not be performed in strong wind, especially jugo.

2. REDUCTION OF SEA AND COASTLINE POLLUTION

- Apply a method of construction which would reduce sea pollution.
- For performance of embankment a pure stone material of larger granulation and with max 5% of earth material should be used.
- Tanks of extra light fuel for heating plant should be performed as double-walled with a device for detection of percolation

3. REDUCTION OF ROAD POLLUTION

- It is not allowed to overload vehicles.
- Transport vehicles should be regularly maintained and washed.

4. REDUCTION OF NOISE LEVEL

- Filling and construction works should not be performed during night time.
- It is necessary to use vehicles and machines which do not produce much noise.

5. PREVENTION OF CULTURAL HERITAGE

- System of protection measures includes supervision of archaeologist during performance of submarine works in Gaženica port area.

6. REDUCTION OF NEGATIVE IMPACTS TO AESTHETIC OUTLOOK OF THE AREA

- All material from submarine excavations must be disposed within intervention zone or implemented in embankment for gaining new areas in ferry terminal.

7. REDUCTION OF NEGATIVE IMPACT OFCONSTRUCTION MATERIAL TRANSPORT DURING TOURIST SEASON

- Material transport works are not allowed during tourist season in July and August.

4.3. MEASURES OF ENVIRONMENTAL PROTECTION DURING PORT UTILIZATION

4.3.1. EQUIPMENT FOR INTERVENTIONS AT SUDDEN SEA POLLUTION

1. It is necessary to provide at least the following:
   - Floating dams for pollution encircling,
   - Absorbing material (sand, granulated clay sawdust...)
   - dispersers (substances based on organic solvents must not be used) and detergents,
   - empty container for temporary disposal of collected material (barrels or containers),
   - tiny equipment – metal funnels, tools, stickers,
   - protection equipment (gloves, overalls),
   - alarm devices (telephone, fax machine, cellular phone).
2. Place for locating this equipment must be marked.
3. Intervention plan in case of sudden sea pollution should be created which contains organization scheme and defined procedures.
4. Form and equip a service for waste collecting

4.3.2. MEASURES FOR SHIPMENT AND RE-SHIPMENT OF HAZARDOUS SUBSTANCES

Part of ferry terminal should be specially organized for settling the equipment and tools necessary for successful prevention/minimalizazion of damages done by spilling or leaking of hazardous substance.

4.3.3. PREVENTION OF MARINE BENTHOS

- All construction works should be performed in limited areas of the sea bottom.
- Pure stone material from quarry should be purchased for sea filling.
- Submarine excavation and extra excavated material should be disposed at filling site for gaining new areas in nautical port.

Slika 1.Disposal of excavated submarine material

4.4. MEASURES FOR PREVENTION AND MITIGATION OF CONSEQUENCES OF POSSIBLE ECOLOGICAL ACCIDENTS

1. FIRST LEVEL OF ENDANGERMENT:

In case of accidents of «first level of endangerment» consequences should be mitigated by urgent action of port employees.

2. SECOND LEVEL OF ENDANGERMENT:

In case of larger accidents of “second level of endangerment”, mitigation of consequences should be done in accordance with Distric plans for water and environmental protection.

5. ENVIRONMENTAL MONITORING PROGRAMME

5.1 CONTROL OF PROCESS OF INHABITING MACROBENTHOS ORGANISMS AND RECOVERY OF SEA BOTTOM COMMUNITIES

1. Processes should be monitored at three transects

   - Transect **GŽ-1**
   - Transect **GŽ-2**
   - Transect **GŽ-3**

2. Regular controls should be performed once in a 4 years period.

5.2. WASTE WATERS QUALITY TESTING

1. Testing location:

   - At outlet of grease separator – settling tank of precipitation sewage: **S-1, S-2,S-3 and S-4**

2. The following indicator should be included at least:

   - pH,
   - total of suspended substance,
   - chemimac consumption of oxygen,
   - biochemical consumption of oxygen,
   - total and mineral oils,
   - anionic and non-ionic detergents.

3. Regular controls should be performed at least four times annually.

5.3 SEA WATER QUALITY TESTING

4. Testing location:

   - Station **KV-1** within fishermen port
   - Station **KV-2** between primary and secondary breakwater out of terminal

1. The following indicators of sea water quality should be determined:

   - transparency
   - temperature
   - salinity
   - dissolved oxygen
   - PH
   - mineral oils,
   - ammonia,
   - bacteriological testings (indicators of faecal pollution)

2. Sea water quality should be controlled:

   - During utilization annually twice during summer months in sea bottom and sea surface layer..

5.4. SEA BOTTOM SEDIMENT CONDITION

1. Testing location:

    - at transect GŽ-1 station SE-1
    - at transect GŽ-2 station SE-2
    - at transect GŽ-3 stationSE-3
    - SE-4

2. In a surface layer of sediments (0-2cm) a contents of heavy metals should be tested:

    - lead
    - copper
    - zinc
    - tin
    - Polycyclic aromatic hydrocarbons

3. Samples shoulkd be taken and controlled:

    - During utilization once in two years period

5.5. NOISE LEVEL CONTROL

Once a year from the moment of ferry terminal work start in cooperation with sanitary inspection acoustic measurements should be performed with a goal of estimation the demand for additional protection measures.

Measuring should be performed at two locations of ferry terminal.

6. CONCLUSION

DESCRIPTION OF THE PLANNED INTERVENTION

Zadar Ferry Terminal falls under port areas designed for transport of goods and passengers in domestic and international traffic.
New areas for whole terminal, as well as for ship berthing will be constructed within Zadar port area by sea filling.
Newly arranged Zadar Ferry Terminal will extend over total surface of 237 200 m^2 (2,4 ha) in land and 321 300 m^2 (3,2 ha) in the sea, in other words sum-total of 558 500 m^2 (5,6 ha).

The construction of Ferry Terminal is planned in two stages. The first stage will be realized in five steps:

- STEP 1. Filling quays and back-areas of the intervention area
- STEP 2. Construction of all maritime structures and coastline
- STEP 3. Arranging all terminal surfaces closing with dimension +2.40mnm with necessary infrastructure
- STEP 4. Construction of breakwater at Punta Bajlo
- STEP 5. Construction of access longitudinal road Bibinjska road – roundabout

The second stage will be realized in four steps:

- STEP 1. Construction of terminal facility with all functions and part of the uunderground garage
- STEP 2. Construction of the second part of the underground garage with arranging green area of a park
- STEP 3. Construction of skyways
- STEP 4. Construction of commercial centre with multi-storey parking lot

The designed capacity would be achieved by fulfilling the second stage.

EXPLANATION OF THE BEST VARIANT

By planned construction of a new Zadar Ferry Terminal in Zadar Port the following constructions are planned within the existing port area:

- of island ferry terminal with port operational areas, quays and back-quay areas
- of terminal for along-coast navigation with port operational areas, quays and back-quay areas
- of international terminal with port operational areas, quays and back-quay areas
- of basement parking lot
- of skyways for ship access
- of commercial centre with multi-storey parking lot
- of navigation control tower
- of parking spaces
- of terminal roads
- of terminal access roads
- of infrastructure objects in terminal: water supply, sewage system, electric supply, telecommunications and heating installations with central heating plant

The best variant of this intervention is determined by design which is the most suitable for system of construction on the sea, gaining new port areas as well as for system of construction of new storages and manipulation areas for Zadar Ferry Terminal.

It is possible to realize the intervention in stages and steps dependant on investment plans and abilities of Investor respecting technical-technological terms of the stage.

The proposed variant is suitable for number of reasons and the following are the most important:

- Zadar Port is a port of special importance for the country, county and town in a sense of passenger traffic
- Physical-planning documentation anticipates the construction of Zadar Ferry Terminal.

By analysing the possible environmental impacts it can be concluded that the construction of new Zadar Ferry Terminal within the existing and planned port, transport and industrial zone will also mean the improvement of the existing state in narrower and wider surrounding of port area.

The construction of Ferry Terminal, as suggested in this Study, improves the existing ecologic state within Zadar port.

THE GOALS OF PHYSICAL PLANNING

1. Physical-traffic organization of port area in accordance with the most modern technological standards and shaping of a coherent coast urban entity with apparent and recognizable features.

2. For the town of Zadar the relocation of Ferry Port to a new location seriously solves physical-traffic and ecological problems, especially of the old centre for a long term:

   2.1. Dividing ferry and boat lines for transport of road vehicles from fast passenger lines,
   2.2. Reducing the large number of vehicles on the Peninsula. This creates new areas on the Peninsula for traffic solution of higher quality on the Peninsula as well as more restrictive traffic regime in favour of inhabitants and visitors of old town centre,
   2.3. In the port basin of the existing passenger port a great quay areas for the acceptance of passenger, excursion and nautical boats will be gained and create an attractive coast ambient for pedestrians and tourists visiting historical centre of the town,
   2.4. Air pollution from exhaust gasses (cars and boats) will be reduced as well as its negative impact to people and cultural monuments,

3. At the new location of Ferry Terminal and business park a new urban structure is created which will stimulate further development and restructuring of the economy and represent a strong focus of town, county and country economy development.

4. A great number of new port functions near the port and within the port itself and penetration of town central and residential functions in a zone of business park provides the balance of physical development of town anglomeration without limits:

   4.1. Establishing a new system of connecting islands by grater number of daily lines will improve economic and total development of islands and their integration with Zadar hinterland.
   4.2. Developing the system of terminals, port and land ones creates precondition for quality connection to interregional roads of domestic and international importance.