Introducing the TramTrain technology in the province of Foggia

*Origins and evolution of the TramTrain project in the contest of the region Puglia.*

The *TramTrain* is already a well known reality in lots of European countries and especially in those countries having a lot of minor rail lines which converge in the main urban nodes. Such lines usually have low traffic volumes where this system has been introduced (with the aim of maximizing the extension of the services from/to the respective hinterlands, without interchange). The TramTrain technology in fact, allows to avoid the breaking of bulk for the distribution of the urban areas in the origin and/or destination. This makes the comparison with extra urban coaches, quite convenient (in terms of generalised cost), even in relatively short routes.

In the case of the region Puglia, which has more or less 1000 km of minor lines (700 of which, are managed by regional operators), there are many different possible applications, as we can consider real short permeations in the urban area but also the transformation of terminal routes of the local network into “light rail”, especially addressing to places of high environmental value and/or places where the tourism needs to be boosted.

The province of Foggia is the area where the application of the Tram-Train technology has immediately shown as being more natural, almost spontaneous.

The different levels of the public administration, responsible of the local scheduling of the public transport, underwrote it. Specifically:

- The Region, which in the PRT - Piano Regionale dei Trasport 2010-2013, Regional Transportation Plan 2010-2013, has chosen Capitanata as the first area of application;
- the Province, the first body who (with the PTCP - Piano Territoriale di Coordinamento Provinciale, Province Territorial Coordination Plan) did see the chance of fully exploiting the potentials of the railways in it’s territory;
- the Area Vasta (Capitanata 2020), which agreed and enhanced the choice of the Tram-Train technology, first made by the PTCP;
- the municipalities of Foggia, Lucera, Manfredonia, Rodi and Vico del Gargano, which have used the indications of the plans, tailoring them to the specific needs of each territory.

Through the PRT (L.R. 16/2008) the region of Puglia has shown to consider the railway as the system on which grounding the structure of the main network, of the local regional public transport.

For this reason the railway services have been structured in a gerarchy and it has been decided to resort to new technologies, such as the TramTrain, in order to meet the specific demand, maintaining fare service costs on the minor lines with medium/low traffic volume. The regional law L.R. 16/2008 “Principi, indirizzi e linee di intervento in materia di Piano regionale dei trasporti”, points to the implementation of the technology “*In order to promote solutions of integration among Light Rapid Transit (LRT) systems and traditional railway systems, which involve the use*
of the promiscuous use of the facility by classical trains and trams (e.g. TramTrain technology), both in urban areas and in places of high environmental value and/or places where the tourism needs to be boosted.

The Piano Attuativo, Implementation Plan, of the PRT 2009-2013 has considered the introduction of the Tram-Train technology in the province of Foggia which, because of its features and its railway network’s configuration, results suitable to a possible progressive extension of the Tram-Train system. This is an element that allows to experiment this technology. As a test case, the Implementation Plan has proposed to introduce the technology Tram-Train along the line Foggia-Manfredonia, with urban penetration inside Manfredonia and Foggia in order to extend this technology, in the future, on the "through" line Lucera-Foggia-Manfredonia. A further application was proposed within the Plan for the northern part of Gargano because of the peculiar characteristics of its places and the important consequences in terms of tourist development that this solution would imply.
network in the province of Foggia through the introduction of the Tram-Train technology (lines Lucera-Foggia, San Severo and Foggia-Manfredonia-Peschici), proposed by the network provider, Ferrovie del Gargano, to enhance connectivity of the Subappennino and Gargano’s territories with the node of Foggia - on the future line AC Bari-Napoli - and to revitalize the role of railways within the Gargano National Park.

Short notes on the Tram-Train Technology.

Tram-Train is a transportation system based on a type of LRT (Light Rapid Transit) tramway vehicle which is, however, able to move both on urban tramways and standard railways, indifferently. The design of this system has been the subject of research since the early 80s and has found its first implementation in 1992 in the German city of Karlsruhe. For all the projects presented in this article, the RegioCitadis (ALSTOM), used for the Tram-Train network of Kassel (Germany), was taken as a recent example of the rolling stock. This is a type of train that has the best features in terms of accessibility: its floor is lowered to the minimum possible for actual Tram-Train convoys, it at the height of 380 mm (in Karlsruhe, the floor is lowered with an average height of 550 mm). Even for newer types of rolling stock, it should be noted that the Tram-Train vehicles with a floor of 380 or 550 mm can circulate anywhere on the tram network and on the entire rail network without the need of adjustments (the floor provides the access to all the configuration of railway platforms) except high-speed lines (Vmax> 160km /h).

The Tram-Train transportation system requires that vehicles may move both on urban tramway routes and railway routes, both on urban routes with road vehicles and on railway routes with railway vehicles. This means that, in order to avoid danger to urban traffic, the Tram-Train vehicle has to have the same technical characteristics of usual trams (with a level of passive safety extremely lower than the level of trains). On the other hand this means that in the railway circulation, the Tram-Train will be in proximity to standard railway vehicles with an higher level of passive safety. Here are the requirements to ensure adequate safety standards for the Tram-Train traffic in this integrated system:

- railway traffic: an increase of the active safety in the new system (Tram-Train vehicle included), to an appropriate level that has to be identified in consultation with the competent authorities;
- urban traffic: the preservation of (at least) the current level and the identification of the techniques and standards to ensure the passage of the Tram-Train system with the railway and tramway system.

The Italian law, describes a vague context, which should allow, within a few years, the mixed circulation in railway and tramway network, as in other European countries; this involves particularly the expected timing of the transposition of the European law. In order for the project not to depend on a homologation process of uncertain length, the solution adopted in the formulation of projects and presented in this document is the segregation between the RFI and the railway network of the other lines. Despite some necessary elements are able to connect the two networks, the infrastructural system doesn’t take into account the possibility for the Tram-Train to travel, in ordinary conditions, on RFI railways network. This avoids the Tram-Train system to have a large (and mutual) interference with the ordinary national network.

The operation considered in the plan of the Ferrovie del Gargano includes the improvement of the railway transport, concerning the line Subappennino-Lucera-Foggia (also aroused by the good results already obtained in the first year of the reopening to traffic, of the line Lucera-Foggia (52,000 passengers/month, 50% of which were private car users, leading to a doubling of the traffic served by public transport). The implementation of the public transport on the line Lucera-Foggia is the only case of the region, in which there is a total elimination of overlaps between rail and car services. This introduce a breaking of bulk at Lucera station for passengers coming from the municipalities of the Subappennino Dauno, including the integration of rail-road fares and line blocks of combined rail-road traffic along the suburban route. Moreover a commercial and experimental agreement with the urban transport manager at Foggia has been made, in order to ensure to passengers the prosecution along the route between the railway station and the final destination in Foggia.

The railway line Lucera-Foggia, thanks to the absence of through traffic and to the possibility of segregation compared to the remaining network of higher hierarchical level, is well suited to the application of the Tram-Train proto-
type, which in the specific case (taking into account the short distances to cover on the ridge), is essential to ensure full competitiveness of the rail transport compared to the car transport: the distance between Lucera and Foggia is just 19 km with the risk that the time to reach the stations, and/or from these, to reach the final destination, are disincentives if compared to the total travel time.

In the specific case of Lucera, the line was equipped with a penetration, now disused, which ended near the historic center. The aim of the project is to restore this penetration into the historic center of Lucera with the application of the Tram-Train technology. At the same time, this leads to an improvement of the interchange with the suburban public transport at Lucera station and strengthening of the line according to the additional traffic demands. Moreover, the way of the disused line is still fully available.

The original penetration of urban railway line in Lucera. Plan and historic photographs.
The restoration of urban penetration of the project.

The expected benefits of the project, primarily relate to improving the competitiveness of rail transport, ensuring the connections for relatively short distances (such as between Lucera and Foggia), including the entire area of the central Subappennino Dauno (65,000 inhabitants) and the node of Foggia in order to offer both the accessibility to the capital, and the adduction to the high-speed railway line Bari-Naples that is a strategic condition to ensure the inclusion of these areas which are at risk of marginalization.

The proposed timetable is a periodic one with 30 minutes interval between two successive train on both direction. The difference with the actual service is that, thanks to the Tram-Train technology, the services will no longer end at the Lucera station, but will continue for about more 700 meters of tramway line, made on the building plane of the disused, rail until Piazza del Popolo (Porta Troia), approaching considerably to the historical center of Lucera. This operational model has been verified by prefiguring a structure of the line, of the types ‘infrastructural’ and ‘process plant’ in order to highlight the specific needs to be calibrated at the design stage.
Briefly, the infrastructural system esteems:

- A single track spur line of about 700 meters forking from the first track rail station in Lucera on the building plane of the existing railway track with tramway features equipped with a terminus stop and an intermediate stop;
- An intermediate point of crossing equipped for dynamic crossover by extending the length of the station tracks, and the change of the signaling system;
- The positioning on a dedicated track at Foggia Station.

**General characteristics of the infrastructure and facilities**

**Railway permanent way.** In the sections where a railway movement is provided, the permanent way does not change the current infrastructure. In the Lucera Station-Lucera Piazza del Popolo section, from the switch that allows the changeover from the first track of Lucera station, it has been planned to adopt grooved rail type R60 with a width of 42mm that does not affect the transit of bicycles on the tramway premises. The tramway exchanges are the type EW 50 according to the standards VDV. In this switches the switch blade is 5.0 m long from the start of the deflected (point of virtual tangency). The turning radius of 50 m is located only in correspondence of the switch point, outside of this frame the curvature varies. Regarding to the superelevation in a curve, taking into account the speed of passage provided on the line Lucera Station-Lucera Piazza del Popolo, no superelevation was provided for curves with radius equal or greater than 150 m. For curves of radius less than 150 m, taking into account that the mixed tramway pre-
mises does not allow to build significant superelevations, a superelevation of max 50mm (corresponding to a transverse slope of 3.5%) have been planned.

**Signal System.** The infrastructure project includes two distinct types of signal system:

- A railway type with SCMT - Sistema Controllo Marcia Treno (Train Control System used on RFI railway network) on the route Foggia-Lucera station, where the movement takes place with railway mode;
- A tramway type, with safety signaling for the management of movements within the route of urban penetration, between Lucera Station and Lucera Piazza del Popolo.

In particular, the major features of the tramway signal system are:

- Interlocking: the single track section between Lucera Station and Lucera Piazza del Popolo is managed so as to allow access to only one train at a time;
- signaling of the route through ground signals;
- “train stop” which leads to an automatic braking when attempting to pass a closed a stop signal;

**Operating Support systems.** At road and pedestrian crossings, the traffic is regulated by traffic actuated signal controls that are activated by the passage of tramway vehicles and that are able to ensure safety. If there are no vehicles in the tramway line, the traffic lights are always green. The presence of an incoming Tram-Train vehicle, is detected through special detection loops embedded in the tramway premises. The road traffic lights become red, stopping the vehicular and pedestrian traffic which would obstruct the Tram-Train way. In this way they allow the free passage on the tramway line. As soon as the Tram-Train has left the intersection, the traffic lights turn into green again.

**Urban Penetration in Lucera.** As already mentioned, the project includes the railway connection with tramway characteristics, along the line between Piazza del Popolo and the station, allowing the Tram-Train system to arrive close to Porta Troia. In the Lucera railway station a new terminal has been planned. It would be positioned to the east of the station building.

In Piazza del Popolo, it has been planned to create a new multimodal terminal. This includes the tram stop (adjacent to the existing station building), the pedestrian connection, some stalls for short term parking and a bus stop equipped for urban public transport.
In detail, the project includes the construction of a platform on the east side of the stop with at-grade boarding (+350 mm above railway level). The platform is entirely covered by a shelter which is connected to the station building (where the ticket office and toilets will be located). From the platform you can access to Piazza del Popolo through the stairs located inside the station, or with a new ramp (also suitable for disabled people) on the west side of the track. Both paths lead to the east side of Piazza del Popolo (where there is also a small car park for disabled and for short term waitings. On the same side, there is a public transport stop, with its platform, shelter deck and pedestrian crossing facilities.
From the tramway platform, through the gate located to the south, it’s possible to connect pedestrians with the sidewalk along Viale Ferrovia and a new ramp leads to Montesanto Street.

The new intermodal terminal at Lucera station connects together the main elements and functions already present in the area (the car parking and bus stops along the street side, the platform along the railway side). These elements, under the new Tram-Train service, require greater integration and the simplification of pedestrian communications within the node. The tram stop is a single track, and it is placed on the building plane of the current platform 1 of the station, in the East area of the station building. The new configuration of the station tracks plan allows to park on the last section of the first track a second Tram-Train vehicle to double (with automatic coupling and decoupling) the one arriving from Piazza del Popolo and thus have double unit from Lucera Station to Foggia, for example in peak hours.

The platform, which has an superelevation of 350 mm above the rails level to allow the at grade boarding, is fully covered by a shelter which also serves the stop area of the urban and suburban buses, planned “as a sidewalk”, in total continuity and adjacent to the tramway platform, to facilitate the interchange.
Fermata dei bus del servizio urbano di adduzione del comune di Lucera e delle principali linee extraurbane a servizio dei comuni del Subappennino. Ulteriori piazzole di sosta per autobus sono previste sul prolungamento del marciapiede del 1° binario fino a perimetrazione il lato settentrionale della sottostazione elettrica; esse potranno essere dedicate ai bus turistici e ai servizi delle linee interregionali che transitano per Lucera; ulteriori piazzole sono previste nell’area pavimentata dotata di marciapiedi in fregio a via Montello, sulla quale potranno attestarsi le linee extraurbane a minore traffico e le linee comunali di servizio alle frazioni del comune di Lucera (servizio suburbano).

Precisely the main stop area provides bus lay-bys in line placed side by side with the common, tram and bus platform. This area is served by a turn lane connected to road network with two new roundabouts, respectively provided in Piazza della Stazione and in the intersection between Montesanto street and Montello street. In this area it has been planned a bus stop for the urban and suburban bus services that serve Lucera and of the most important municipalities of the Subappennino.

Further lay-bys for buses are provided on the extension of the sidewalk on platform 1 until the cordon off the northern side of the electrical substation; they can be dedicated to the tourist buses and to the interregional lines passing through Lucera. Additional bus lay-bys will be created on the paved area with platforms in front of Montello street, where the suburban lines with less traffic and the municipal lines of the municipalities of Lucera (suburban services) will stop.
The construction of a new building for the facilities of the bus station (ticket office, bathrooms waiting rooms) are will be located between the two stop areas.

The shelter of platform 1, which goes to the West until the F.V., continues to the East to Montesanto Street, and to the North into the second area of bus stop and the pedestrian crossing (to reach the interchange park upstream Ferrovia Street). At its East the building of the bus station is positioned (where there will be waiting areas, ticketing and toilettes). In front of this building, in Ferrovia street, the project of a second stop area for urban and suburban bus has been planned. This has to be used in the hours where most means are expected and when the stop area “at sidewalk” is saturated.

First of all, to exit in the direction of the historical center, the tramway premises must intersect the “multi-modal platform” of the first track, designed in continuity with the platform of the shunting neck and in front of the F.V. To ensure the continuity of pedestrian connections along the curving segment, the gap between platform and rail level
will be reset with a slip road. Successively, the tramway curve “cuts” the stop lane and almost perpendicularly, Viale Ferrovia. In addition to a signal control system connected with the tram, for further safety the conflict areas will be highlighted by modifying the aspect of the pavings.

**Point of crossing at Vaccarella.** With the aim to reduce the travel times between Foggia and Lucera, it is planned to work on the track layout of the point of crossing of Vaccarella, to allow the crossing without stop (i.e. between moving trains). The project involves the realization of the independency of the routes and the lengthening of the module of stabling tracks and their circuits (of about 500 m net of switches). Furthermore, since the rolling stocks of Ferrovie del Gargano are equipped with a Train Control System (of type SCMT) for automatic protection of the train run, it is suggested to equip the whole line Foggia-Lucera with the equivalent ground subsystem, to raise further the safety level of the route (especially during crossings). This system should still be adopted on the line within 19/3/2011, according to the directive of the Ministry of Transport, Decree No. 81 / T 19/3 / , 2008. In addition it is proposed to adopt the “infill” system for the early release of the braking curve set through the SCMT system on the routes of departure/arrival of the correct path.

The proposed project deals with the upgrading of rail transport in Foggia’s area through the revitalization of the currently underused railway line Manfredonia - Foggia. The project involves the electrification of the railway line and its transformation into a tramway from the Frattarolo station, where a railway branch comes off towards the industrial port. This operation implies the elimination of the barrier effect, created by the railway (in the relation town/sea) and can lead to a relocation of large brownfields belonging to the FS group and located near the old town center. In the urban field, the railway of Manfredonia intersects the town so significantly, that it creates a barrier having a strong negative impact on the urban structure of the western part of the city. However, this element can become an advantage if submitted to an increase of the system accessibility (by rising the stop number) and to a transformation of the permanent way promoting the horizontal permeability and giving a strong and positive impact to benefit of the residents, the total mobility and the urban landscape.
The aim of the project is to ensure the penetration to the center with the introduction of The Tram-Train technology, the improvement of the interchange with suburban public transport in the new station of Manfredonia West and with the strengthening of the line according to the additional traffic demands. Primarily the expected benefits in the suburban area relate to the increase of competitiveness of the rail transport, in order to guarantee the connections between short distances such as Manfredonia and Foggia (35 km), within the southern area of Gargano (100,000 inhabitants) and the node of Foggia, to offer both accessibility to the main town in the district and the adduction to the line high speed railway Bari-Naples that is a strategic condition for the support of tourism.
In terms of public transport there is a possibility to make an important action to rationalize and improve the total supply: currently, on the Manfredonia - Foggia corridor there are over 400,000 bus\textsuperscript{km} of bus mileage that overlap with rail services.

In a second phase of the project, the penetration in the urban field of the Tram-Train, will be possible in the main town in the district as well, from Foggia’s station as far as the downtown, as required by the Urban Mobility Plan of Foggia. So, the main points of interest will be served, with a further, evident and very relevant impact on the at-
tracted demand; starting from an improvement of the direct accessibility of the railway, to the total compensation of the bus-train interchange time for all the town of the southern part of the Gargano promontory.

In detail, the proposed project relates to the replacement of the current rail-road system with a rail service, cadenced at 30’ over the dorsal Manfredonia - Foggia, that uses the the Tram-Train technology. The proposed solution involves the creation of penetration with tramways characteristics in urban field in Manfredonia. The Tram-Train technological features are able to allow the maximization of the benefits (access to the system and frequency) with few interventions, using the existing infrastructures and their peculiarity (eg. the speed on the rail routes, the possibility of complex organizations of the system with light infrastructure, the penetration in urban areas).

The planned actions are:

- The introduction of SCMT Train Control System for all the existing lane and the transformation of the point of crossing of Amendola in a dynamic one in order to reduce the travel times;
- The restoration of railway penetration in Manfredonia until Marconi Place with the introduction of The Tram-Train technology;
- The implementation of tram overpass for the connection between the line and Foggia station;
- The electrification and upgrading of safety systems.
Penetration in Manfredonia - Piazza Marconi.

Siponto stop
To have the possibility to operate periodic timetable for the train services first and the Tram-Train secondly, it is necessary to provide the construction of a point of crossing in a position between Manfredonia and Foggia. The characteristics of the existing rail infrastructure, in long stretches on embankment in the central part, and the evident logistic opportunities, suggest to provide this P.M. at the past crossing station of Amendola (currently disabled), although this is not exactly equidistant from the two doubling sections of Foggia and Santa Maria di Siponto. To minimize the delay at the intersection where the train has to give yield and to minimize the resulting discomfort to passengers, the new PM provides the possibility of dynamic intersection, without stopping the train that has to give yield. For this purpose the railway project provides a stretch of doubling of 700 meters. The safety plant is constructed in order to allow the independence of the input and output routes in both directions. It is planned to use switches such S60UNI/400/0,074, that allow to travel diverging routes at speeds up to 60 km/h.

**LINE PESCHICI-SAN SEVERO: PRELIMINARY DESIGN FOR THE APPLICATION OF THE TRAM-TRAIN TECHNOLOGY ALONG THE SECTION ISCHITELLA-RODI G.-PESCHICI CALENELLA**

The project proposed by the Ferrovie del Gargano deals with the improvement of the rail transport on the final section of San Severo-Peschici railway that interests the northern area of the Gargano and guarantees its connection, through the junction with the Adriatic railway at San Severo, with Foggia, Puglia and the rest of the country. Primarily...
the expected benefits relate to the improvement of direct rail connections of the northern area of Gargano, that is
the main tourist district in the region, with the node of Foggia in order to ensure the connection with the airports of
Bari and, ultimately, the supply to the high speed railway Bari-Napoli. In this context, the main motivation for the ap-
plication of the Tram-Train technology is the possibility of thickening of the stops and, through the transformation of
the line from railway to tramway, of reduction of the barrier between the settlements and the coastline along this
line. In particular, between Peschici and Ischitella in summer period, there is a great increase of demand for internal
connections with public transport, to address the structural congestion of vehicular traffic and the reduced parking
supply.
Specifically, the project involves the last 13 km of the existing line San Severo - Peschici that, in its actual route of
about 78 km, crosses two areas with very different settlement systems. The first section, San Severo-Ischitella, inter-
connects all the major towns in the north of the hinterland Gargano, and these with the national network. The section
is currently part of an important project that aims to lower by 30% travel times from Ischitella to San Severo, by 2015.
The full development of the investments already made, however, requires also a project for the final part, Ischitella-
Peschici Calenella, which crosses a densely populated area with heavy mutual interference. This is the reason why it
is important to use the tram-train technology (in this case immediately made feasible by the possibility of segregation
than the rest of the line network), which finds its full justification in the need and essential priority of coastal munici-
palities for mitigation of the barrier created by the present railways infrastructure between settlements and the
coast. The project, with the complete reorganization of its 13 km of line, with the introduction of many additional
stops, with a detailed integration with the crossed area, provides the conditions to develop models of sustainable mo-
bility in this delicate environment. In particular, the line directly serves the new port of Rodi Garganico with a dedi-
cated bus stop and it’ll ensure an efficient intermodal rail-sea to all tourists headed to the Tremiti Islands. The
project’s realization is divided into two functional and working lots:

- Functional Lot 1, with an immediate implementation, which provides for the introduction of the Tram-Train
technology, and the improvement of services on the route Ischitella-Peschici Calenella.

- Functional Lot 2 which involves the construction of the new route Peschici Calenella-Peschici City and the
  consequent extension of the technology services.
Chorography of the project.

With regard to the functionality, the activation on the section can be divided into two consecutive phases. The first phase, with an immediate implementation, provides for the total segregation between rail and tram services, with the
interruption of the current train service to the Ischitella station or to the Rodi Garganico station, according to the specific transportation needs related to the different seasonal demand that has to be fulfilled. In both cases it is planned to use the portion of the current line that is no longer characterized by the railway rolling stock, for the activation of a TramTrain service to the small town of Peschici. The second phase includes the mixed circulation of both railway rolling stocks and the Tram-Train until San Severo, and it will be implemented when Italian legislation will consider this possibility (as the European legislation already does), which will enable this type of service on the main continental networks. In the long period, it has been planned to operate a periodic timetable based on Tram-Train between San Severo and Peschici and with reinforcement services during the peak hours between Rodi and Foggia / Bari done with railway materials.

In both phases of the implementation, during the summer period along the section Ischitella(Rodi) -Peschici, it has been planned an improvement of the TramTrain services with a periodic timetable and a scheduled period of 20’ on both directions, that will be able to define a competitive alternative to private cars on the entire coastal belt, with a full integration with the cycle-pedestrian mobility and the public services on the road.

Graphic timetable of the period of simulation between San Severo and Peschici

The infrastructural and technological actions, together with the described features, are able to allow the activation of a TramTrain transport system between Ischitella and Peschici Calenella, with the possibility of mixed rail services from San Severo (Foggia-Bari) to Rodi, or segregated services according to the possible adjustment of legislation in this field. These actions are:

- Change of tracks layout and of the interlocking system at Ischitella Station to allow the possibility of segregation between the sections San Severo-Ischitella and Ischitella-Rodi; change of platform geometry and of the outdoor square to facilitate the modal interchange between the different modes of transport (rail, tram-train, bus, private car, slow mobility);
New structure proposed for the rail system and for the intermodal node at Ischitella

- Modification of the signaling systems for the line along the section Ischitella-Rodi to ensure an adequate level of security because of the significant increase in the provided traffic on this railway section compared to the current situation;
- Improvement of existing railway stops of Guardiola, SantaBarbara, Sottocosta and Rodi Porto;
- Change of the tracks layout and interlocking system of Rodi Station to allow the possibility of segregation between the sections Ischitella-Rodi and Rodi-Peschici and to improve the system in terms of number of abutting trains that circulate between San Severo and Rodi and the tram-train that circulate between Rodi and Peschici; change of the platform geometry according to the improvement in order to facilitate modal interchange between rail and tram-train; change of areas belonging to the station in terms of accessibility to improve pedestrian accessibility and permeability to the waterfront.

New structure proposed for the rail system for the northern part of the project of Rodi

- Arrangement of tramway in the section between Rodi Station and Peschici (increase of transverse permeability and reduction of the sonic and visual impact);
- Change of the protection system of the crossings along the route Rodi Station-Peschici by the replace of the current levels crossing with signalized intersections for the tramway circulation;
- The modification of the power supply system in the new tramway section Rodi Station-Peschici, with the transition from a rail system with 3000 V c.c. to the tramway system with 750V c.c.;
• Construction of new substations in order to bring the voltage to 750 V c.c.;
• Change of the operating system (from rail to tram);
• Construction of new stops in the most important touristic, residential or access to services points along the route Rodi Station-Peschici;
• Adjustment of Vico-San Menaio station, with the simplification of systems and improvement of pedestrian accessibility and permeability of the functional areas that have no relevance anymore;

New Proposed structure for the rail system for the northern part of the project of Vico-San Menaio

• Adjustment of Bellariva actual stop;
• Change of Peschici-Calenella station with the adjustment of the tracks and platform; realization of tracks for the parking of the unused trains and clearing and minor maintenance equipment;

New Proposed structure for the rail system for the northern part of the project of Peschici-Ischitella
The project also includes a series of complementary measures to reduce the landscape impact of the existing line and improve its integration with the environment, urban planning and settlement context, with particular attention to tourist and bathing activities that characterized the coast of Gargano:

- application of acoustic profiles on the tracks to reduce noise impact;
- grassing of the track;
- implementation of traffic-calming systems and elimination of architectural barriers at bus stops to facilitate pedestrian permeability, improving the safety conditions of SS89 and simultaneously ensure the improvement of the adjacent context.

Sections of the type stop with tram system