sous la direction de
LAMIA HADDA
SAVERIO MECCA
GIOVANNI PANCANI
MASSIMO CARTA
FABIO FRATINI
STEFANO GALASSI
DANIELA PITTALUGA

Villages et quartiers à risque d'abandon

Stratégies pour la connaissance, la valorisation et la restauration

TOME 1

FIRENZE UNIVERSITY PRESS

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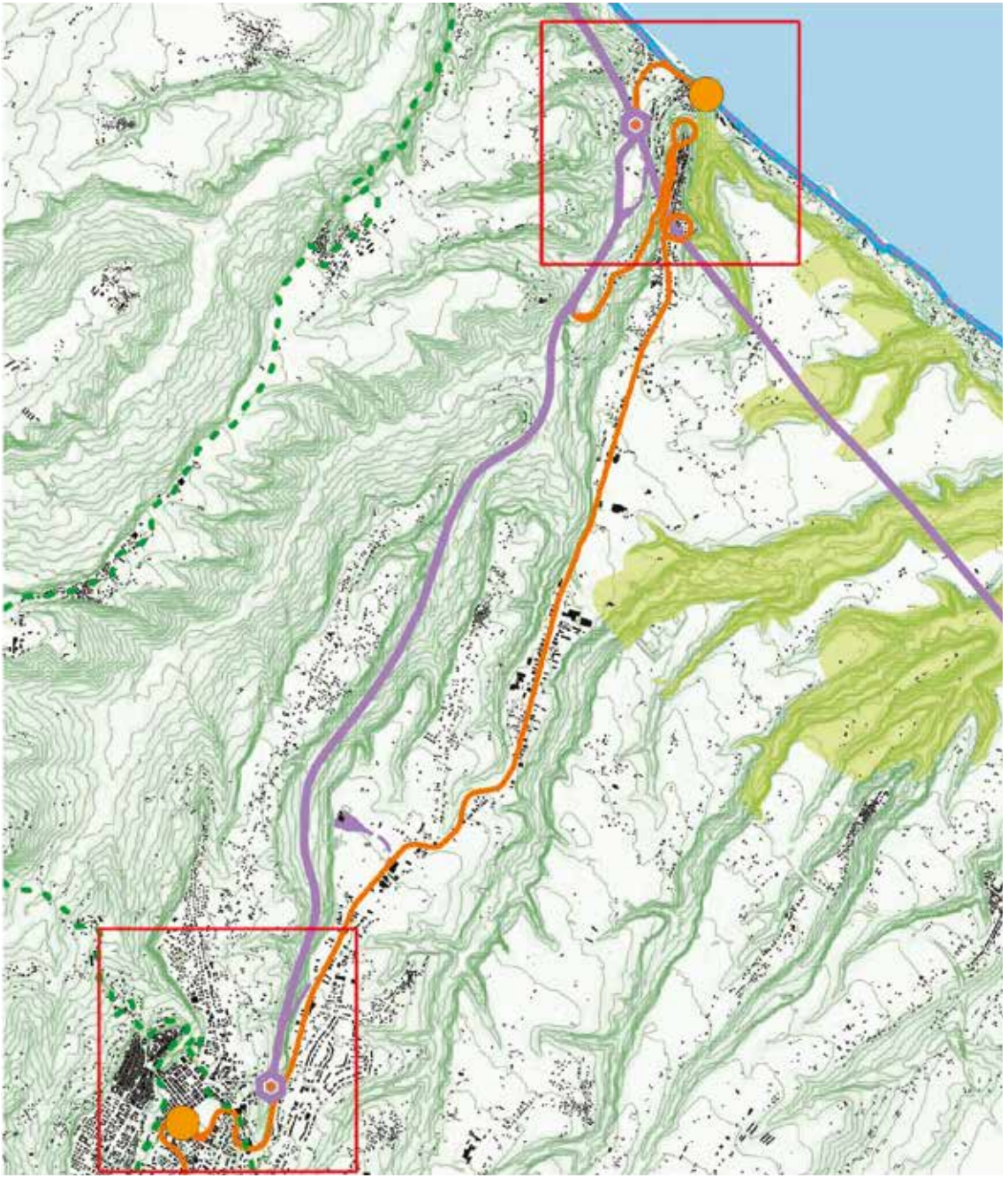

SLOW MOBILITY AS A CONNECTION DRIVER FOR FRAGILE TERRITORIES BETWEEN COASTLINE AND INNER AREAS

Domenico D'Uva
Politecnico di Milano-Italia

Chiara Ravagnan, Giulia Bevilacqua
Università di Roma "La Sapienza"-Italia

Mapping of slow connection between Lanciano and San Vito Marina. In purple active network and stations, in orange the dismissed railway. In light blue the Ciclabile Costa dei Trabucchi. Dashed green lines are Tratturi tracks. (Author D. D'Uva).

The right to a sustainable and inclusive mobility represents today a key issue of the debate on fragile territories, in a perspective of territorial rebalancing, environmental regeneration and socio-economic resilience, starting from a growing awareness of the complex links between depopulation, abandonment and divestment of the infrastructural heritage as well as the effects of the car-centric mobility model.
In particular, the connections of the inner areas between the smaller centres involved in depopulation and the main nodes of the territories on the coast are possible today only with private vehicles. Furthermore, sectoral policies relating to large infrastructures have often increased the gap between "fast territories" and "slow territories", without providing effective solutions to increase the quality of life of the inhabitants of the most fragile territories.
This research activity is aimed at deepening this issue, facing, as a study area, territories with particular morphological and structural conditions, pointing out how the instances of territorial rebalancing, environmental regeneration and socio-economic resilience of fragile territories can find a possible solution in the planning of an intermodal and sustainable mobility system. In particular, in these conditions, slow mobility is characterized by high potential and, at the same time, criticalities, such as the potential system that links the Costa dei Trabucchi in Abruzzo to the inner areas of the Basso Sagro. The rugged feature and, at the same time the great landscape and cultural value of this territory have fostered the use of innovative tools for the analysis of connection networks. Cycling is an archetype of a "resilience path", which arises from the phenomena of abandonment of the railway networks, reversing the vicious circle of abandonment. The slow routes become essential drivers of accessibility and sustainability if designed starting from the evaluation of slopes and travel times between the hill towns and the coast, both for daily transport and for tourist travel, which make the flows change rapidly and significantly with seasonality.
San Vito Chietino and Lanciano nodes and the ridge that connects them have been studied integrating, in an interdisciplinary way, qualitative and quantitative-parametric methodologies. The integration of the approaches is indispensable for the evaluation of the complex system of relationships that cross the disused railway lines, with the related stations. This network can represent a possible development driver if it is able to effectively connect, through the reuse of the tracks of disused railways, the intermodal nodes of the new stations to the smaller centers, to the Via dei Trabucchi, to the networks that have connected the territory in the past, such as that of the Tratturi, whose main route runs along Lanciano and connected it to Crecchio, linked to the Cammino di San Giacomo. The slope that characterizes this territory is certainly an important aspect to be evaluated for the feasibility of the routes in this area, for which a three-dimensional NURBS model has been realized starting from geographical data. A combination of GIS and parametric design tools is applied to geographic data for in-depth network analysis. The expected results of the research and experimentation are related to the definition of guidelines for

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Fig. 1
The railway line and the Trabucchi Coastline from the historic centre of San Vito Chietino (ph. C. Amato).

a multi-scalar and intermodal mobility system, which involves different types of mobility in relation to the context, trying to enhance the latent resources in terms of territory and landscape and at the same time, addressing accessibility issues, to foster a reactivation in terms of new opportunities and liveability of these territories.

Keywords: connection, parametric analysis, railway, cycling, cultural heritage

From fragilities to regeneration, through territorial networks and research paths

In the last decade, Italy has led the debate and the experimentation focused on the theme of "inner areas" and territorial "fragilities" (AAVV, 2017), fostering new interdisciplinary

research paths, innovating the National political agenda, triggering a different use of National and European funds.

In this framework, the revitalization of small historic centers, affected by depopulation, socio-economic decline and abandonment of the built and infrastructural heritage, is a key issue to be addressed through a holistic vision, bearer of effective cognitive approaches and integrated regeneration strategies.

The research path and project experimentation illustrated in this contribution are in line with this vision aimed at keeping together the ranks of a possible mending due to that territorial capital consisting of material and immaterial networks that link the smaller centers to each other and to the most dynamic contexts.

This research activity is configured as the outcome of the convergence and coordination between two research paths: the project of the Department of Planning, Design and Technology of Architecture entitled *Resilience Paths. The relaunch and reuse of minor railways for the regeneration of fragile territories* financed by the Sapienza University of Rome and the project *Fragile Territories* held by the Department of Architecture and Urban Studies of the Politecnico di Milano.

In particular, this study focuses on the divested minor lines that connect the inner areas to the Mediterranean coast[1], investigating with an interdisciplinary approach the opportunities that emerge from a possible strengthening of the cycle/pedestrian system. The realization of greenways represents in fact, in fragile contexts, a scenario of sustainable development (Lille Declaration, 2000) and a proactive resilience strategy (Pike & al., 2010). This line of intervention arises from environmental, economic and cultural demands and is supported by innovative methodologies that ensure technical and economic feasibility, in consistence with new sources of financing.

This contribution therefore intends to investigate the main fragilities and resources of the Abruzzo territory between the Adriatic coast and the inner areas of Basso Sangro in the Province of Chieti, along the Sangritana Adriatic Railway (FAS), which is affected by the phenomena of divestment strongly interrelated with the phenomena of depopulation and economic decline. Starting from the awareness of these fragilities, the second part proposes an intervention methodology for the reconfiguration of the infrastructural system in a sustainable perspective, paying attention to the feasibility of a cycle path between San Vito Marina and Lanciano, within the framework of an intermodal mobility system. This experimentation opens the final reflection on possible "resilience paths", integrated

[1] This reflection is also part of the debate that arises from the International Research Network Medways- Le Vie del Mediterraneo, promoted by the University of Trento and the Accademia dei Lincei.

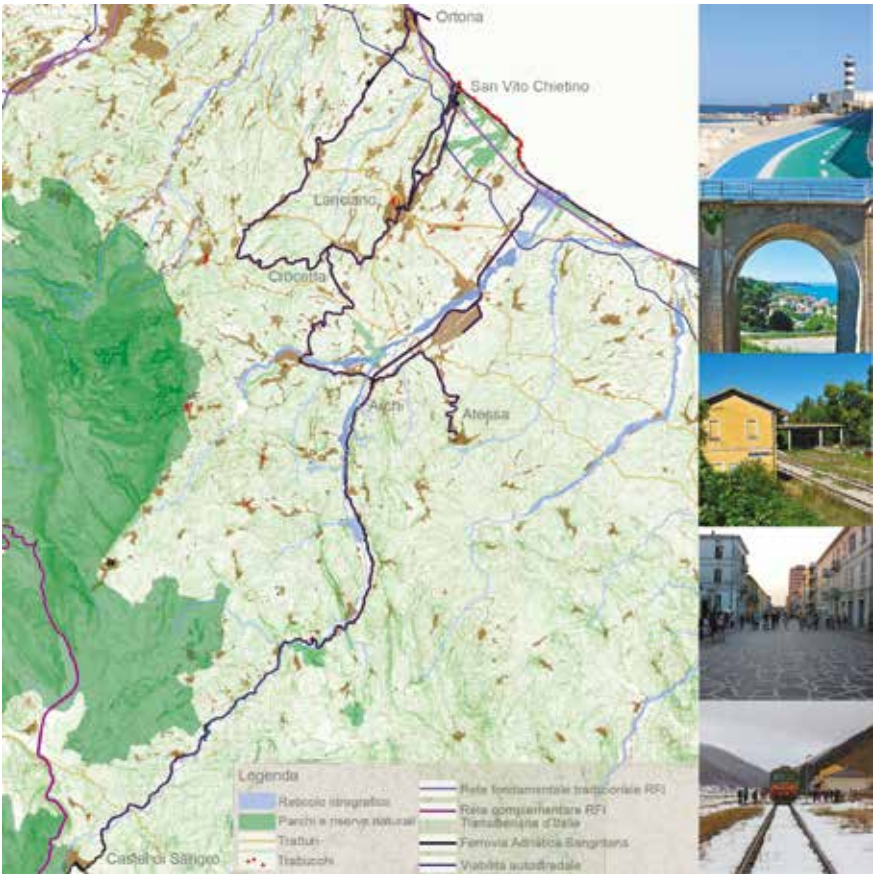

Fig. 2
The historic, infrastructural and natural networks from the Majella National Park to the Adriatic coast. (Author C. Ravagnan). On the right, from the top: the Trabucchi greenway in Ortona, the dismissed line in San Vito Chietino, the dismissed San Vito Trasbordo station, the historic centre of Lanciano and the Transiberiana d'Italia touristic line in the Majella Park.

regeneration scenarios between the coast and the small inner centers, illustrated in the final paragraph.

Infrastructural networks, environmental connections and cultural traditions, from the Adriatic coast to the inner areas of Abruzzo

The research *Resilience Paths. The relaunch and reuse of minor railways for the regeneration of fragile territories* has placed the theme of material and immaterial networks at the center of the reflection on the decline and regeneration of inner areas. From this point of view, the weaknesses and strengths of networks are considered, at the same time, main components of territorial fragility and strategic elements for regeneration through

an opportunity of relaunch of ordinary services, promotion of tourist railways or construction of greenways (Ravagnan, 2019).

Among the various case studies analyzed in the research activity, the Abruzzo region, located in central Italy, is an emblematic example for a reflection on the strategic role of divested railways for the purposes of territorial rebalancing, landscape fruition, environmental enhancement and urban regeneration of small centers and widespread heritage.

In this context, the area that involves the Provinces of Chieti and L'Aquila is characterised, on the one hand, by a weakness and abandonment of the railway network system, mainly due to its orography, which has low populated and isolated centers, with problems of accessibility; on the other hand, by a complex system of ecological, historical and infrastructural networks that connect the Adriatic coast to the inner areas of the Apennine ridge through paths dotted with historic centers and areas of strong landscape and naturalistic interest, with a strong identity linked to the memory of ancient, modern and contemporary history. (Fig.1)

In particular, among the many disused or underused lines in Abruzzo, the abandoned line that runs from San Vito Marina to Castel di Sangro, better known as FAS, plays a strategic role. As it crosses the Region it meets many small historic centers of great value (such as San Vito Chietino, Lanciano, Castel di Sangro), areas of high naturalistic value (from the Regional Nature Reserve Grotta delle Farfalle on the coast to the Majella National Park), signs of the stratification of the territory (such as the network of *tratturi*) and widespread historical elements; the FAS, in fact, connects the inner area of Basso Sangro-Trigno with the Adriatic infrastructural system and the coast near Ortona (Cf. Fig. 2), known for the very rough and inaccessible historic urban landscape and for beaches and cliffs whose icon is the famous *trabucco*, a complex artefact of the traditional local Adriatic coast, immortalized as a "fishing machine" by Gabriele d'Annunzio (Cf. Fig. 1).

The Sangritana Adriatic Railway, part of the secondary and regional network, was inaugurated in 1912, after a long and tormented gestation that lasted well over half a century. The project, part of a wider plan that intended to connect Naples to Rome but was suspended due to the fall of the Bourbon Kingdom, was entrusted to the Milanese engineer Ernesto Besenzanica and provided for a 156 km long line starting from the already existing Castel di Sangro station, which was part of the Sulmona - Isernia line, it followed the Sangro Valley, then continued to Casoli as far as Crocetta, where it bifurcated, continuing with a branch as far as San Vito Marina, passing through Lanciano, and with another branch towards Ortona, passing through Guardiagrele. To this main line was added another small trunk from Archi towards Atessa, which is the only branch that has been built with respect to the larger project of connections to nearby centers. The entire railway line was built in only four years, between 1911

Fig. 3
The historic centre of San Vito Chietino (ph. C. Amato, Google maps).

and 1915 and was electrified between 1921 and 1929, representing a great innovation in the technological and railway field as at that time it was the largest direct current electric railway in Europe.(Fig. 2)

In the first years after its construction, FAS, with its 1.3 million passengers per year and with 42 stops and stations serving 40 municipalities, excellently performed the tasks assigned to it, being the only direct connection of the Frentane and Sangro areas and acquiring a significant importance also in the transport of goods. However, the Second World War caused considerable damage to the FAS because of its strategic role as an important Adriatic-Tyrrhenian crossroads, it was systematically destroyed by the German Armed Forces, leading to the first suspension of service from October 1943. The line

resumed its activity only in 1945, when it returned to be accessible on the section from San Vito to Lanciano, as a result of the strong commitment of the Sangritana's staff who formed a "Cooperativa di Lavoro" for the voluntary reconstruction of the railway. In the '50s, after the industrial crisis of the post-war period, several economic operators began to invest in the Sangro Valley, opening industries, thus activating a reversal of the migratory phenomenon and a revitalisation of the area, stimulated by the existence of the Sangritana, the most comfortable and convenient means of transport for raw materials and products. (Fig.3)

Like many other minor railway lines, the FAS continued to perform its function until the '80s, when the slow but continuous decline in passengers, due to the increasing proliferation of road transport and the increase in the use of private motorisation brought the line San Vito-Castel di Sangro to the closure, despite the works promoted by the Ministry of Transports started extensive renovation work.

In the context, the idea of the reuse of the railway line in a tourist perspective was developed toward the opening of the *Treno della Valle* – the "Valley Train" - in 1987. The tourist convoy proposed the discovery of the historical, artistic and environmental heritage of the Valley of the Sangro River, reaching 35,000 attendees in 1994. The '90s marked a period of profound technological and infrastructural changes for the FAS and in 2005, in order to allow a rapid modernisation of the line, the railway service, already limited to the Archi - Villa S. Maria section, was definitively suspended between Lanciano and Castel di Sangro. Finally, with the opening of the new line between Ortona and Casalbordino by RFI (Rete Ferroviaria Italiana -Italian Railway Network) also the FAS trains abandoned the historic station of San Vito Marina and the old route to settle, through a new connection, in the new RFI station of San Vito - Lanciano.

The old railway path that climbs the ridge of San Vito Chietino, which once guaranteed the accessibility of the historic centers of San Vito and Lanciano and which is now replaced in the first section by the new railway network at the bottom of the valley, is now an abandoned line. Its closure, in addition to the state of abandonment of the territory, has temporarily canceled paths of privileged perception of the natural and cultural landscape, interrupting a network of material and immaterial cultural values between the coast and inner areas. This situation underlines the need of a multi-scalar and resilient strategy of regeneration that involves the different types of mobility trying to enhance the resources of the territory and the landscape and at the same time, face the long-standing problems of accessibility and improve the contemporary habitability of these territories.

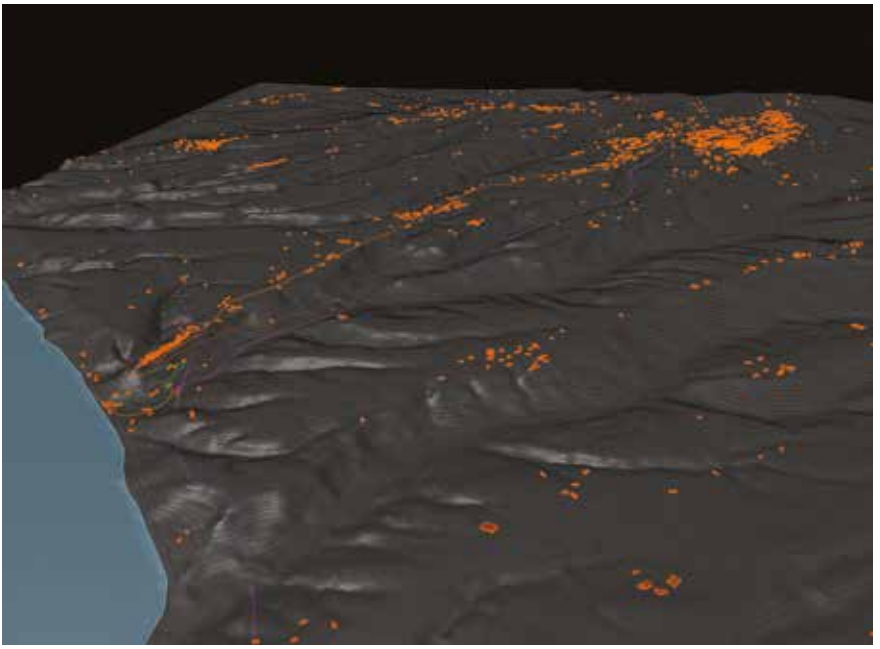

Fig. 5
3d automated landscape generation. Slow connection network in relation with orography. (Author D. D'Uva).

An intervention methodology for the reuse of the Sangritana railway between San Vito Marina and Lanciano

The Department of Architecture and Urban Studies of Politecnico di Milano, within the project *Fragile Territories*, has been conducting since 2018 a research project on territorial fragilities in Italy (C. Dezio et al, 2020). In the framework of the interdisciplinary research that is in progress at the time of writing this work, there is an in-depth study on the experimental mapping of the coastal and hilly territory that refers to the Costa dei Trabucchi. This territory has an orographic configuration characterized by deep river valleys transversal to the coastline, interspersed with hilly ridges where the most inhabited centers are located. Furthermore, the coastal areas suffer from a seasonal variation of the population that makes the mobility policies difficult, which may cope with both the winter and the more complex summer layout.

The research work undertaken by the Department aims to improve intermodal connections by using soft mobility strategies to connect the hill towns with the coast within an inductive process that starts from an empirical phase up to a proposed design strategy for the disused railway line between Lanciano and San Vito Chietino. In this general framework,

the aim of this paper is the illustration of the empirical survey of the different methods to manage the complexity of the relation between connections and territorial features.
The networks on this territory follow the constraints of the orography; Adriatic SS16 National Road, A14 highway and railway networks are fast connections that run along the coast; the slow ones, the local railway and the road are transversal. The intermodal node that connects these two families of networks is located in San Vito Chietino, which will be the subject of a more in-depth analysis. (Fig. 4)
(Fig. 5) In this territory the disused railway line that connects the coast with Lanciano overcomes the considerable height difference with an ingenious series of viaducts and helical tunnels. The analysis of this coastal strip has pointed out the need for orography assessment in the planning and design of slow mobility. This analysis was carried out using the tools of territorial analysis such as GIS in parallel with NURBS (Non Uniform Rational Basis-Splines) modellers, (D'Uva, Eugeni, 2019), interfaced with parametric digital tools (Bielik, 2012). The choice to operate with NURBS technology, instead of the traditional Mesh (D'Uva, Eugeni, 2020) was guided by the precision and effectiveness of multi-scalar manipulation, which are made possible only by the mathematical nature of the NURBS elements. The parametric 3D model of this area has been generated with the Open Data Cartographic database of the Abruzzo Region. In particular, DTM (Digital Terrain Model) raster, generated by interpolation of the altimetric data taken from the Regional Technical Map, has been used.
Through this digital ecosystem it was possible to accurately model the landscape at the large scale of the Lanciano - San Vito line and at the small scale of the San Vito connection, which required a different deepening. The three-dimensional landscape modelling, which includes building, railway and roads networks, was very useful to undertake a quantitative analysis. For developing a soft mobility policy, it has been necessary to analyze the slope of all the roads of the area with a specifically designed parametric tool, selecting paths with a value of less than 10%.
The analysis was applied to the area of San Vito Marina, where the disused station is a node of connection between the "Costa dei Trabucchi" greenway and railway network. Due to a lack of georeferenced data, a GPS tracking survey was performed of the greenway. From this node, the connection with the current-San Vito-Lanciano station has been hypothesized over the dismissed line. From this node has been applied the slope algorithm already explained to identify on the road network which could be the easiest connection with the dismissed helical railroad. (Fig. 6)
This methodology allows a fluid elaboration of the three-dimensional model starting from the DTM, despite the limits imposed by the computation time of the single steps. It has been

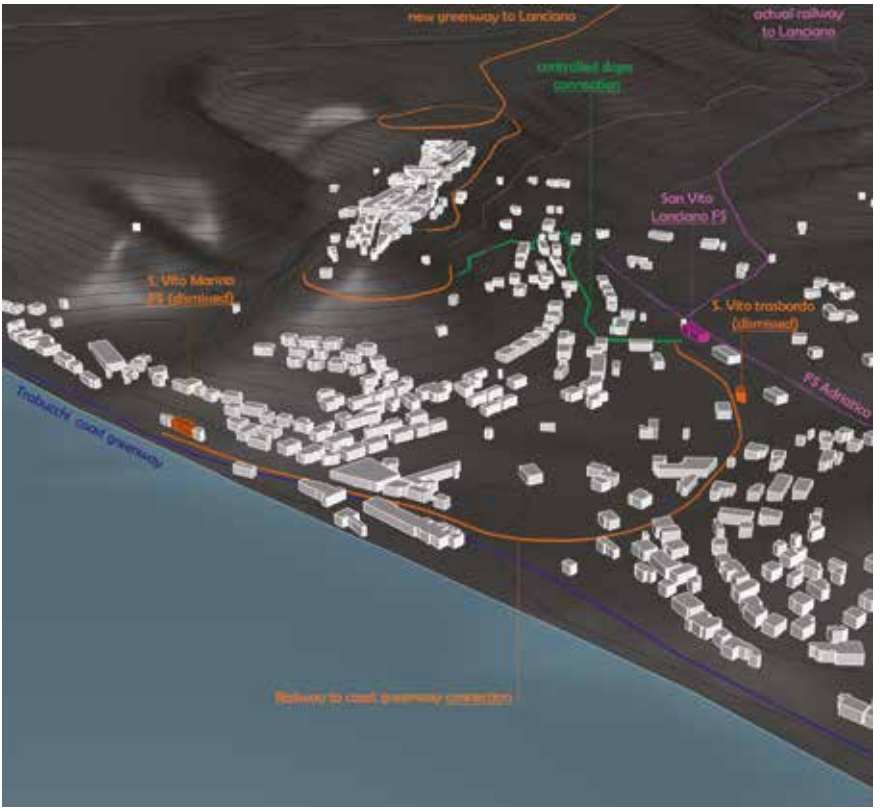

Fig. 6
Study of San Vito Marina Area - controlled slope connection path has been automatically generated with an algorithm that worked through the minimum slope between actual and dismissed railway network. (Author D. D'Uva).

necessary to set some compensatory parameters that could optimize the precision of the model with the real possibility to elaborate it to reach the aforesaid fluidity. The first step of the procedure involved the Abruzzo region DTM raster, which had a mesh of 10 meters; creating the 3d landscape with this resolution would have lengthened the computational time too much. The analysis was finally carried out by reparametrizing the starting raster into a new image with a 40 meters' pitch, which is lighter in computational terms. The generation of the digital urban landscape for the general framing of the Lanciano - San Vito line and the one for the head station was elaborated with the same algorithm but produced two different results. This algorithm takes as an input the polygons of the building outline, projects them on the DTM, creates a plane passing through the centroid of the projected outline, makes a new projection on this new plane, extrudes the polygon of a fixed height and creates the roof of the buildings. The algorithm independently

performs this series of operations on all 18237 buildings in the area, but it would require an extremely long computation time, so all the buildings were used only for the analysis of the area surrounding the San Vito station, freezing all the artifacts outside the single analysis area. For the generation of the digital landscape of the entire analyzed segment, a filter was used that extracted only 1515 buildings whose surface is larger than 500 square meters, then inserted in the algorithm as input. This selection was necessary not only for the already exposed computational reasons, but also for the optimization of the representation. Because of the computational burden and the different road layout, the next step of the research will be the application of the same methodology to the Lanciano node.

Scenarios of integrated regeneration between the coast and the smaller centers

The multidisciplinary analyses carried out on the territory configure the reuse of the abandoned FAS line in San Vito Marina-Lanciano section as a project of environmental regeneration, infrastructural mending, landscape fruition that takes strength from the presence of the new railway line - to which it could be connected with intermodal hubs - and from the connection with important naturalistic and historical paths such as the *Greenway of Trabucchi* along the coast and the *Tratturo* L'Aquila-Foggia. The proposed analysis could be the methodological reference for drawing up a design strategy, which could lead to social and economic regeneration. (Fig. 7)

The slow mobility path is meant as a vector of connection between the coast and the inner areas, to be combined with a possible restoration of the *Treno della Valle* and of the ordinary railway line. This dismissed track run between Lanciano and Archi and between the new station of Fossacesia-Torino di Sangro, Archi and Castel di Sangro, that is recognized as essential network in the *Strategia d'Area interna Basso Sangro-Trigno*.

It also reaches in Castel di Sangro the "Transiberian Railway of Italy", a touristic line promoted on a dismissed secondary line, known in terms of revitalisation of small centers (Amato & al., 2020).

This network could represent a system of functional and cultural relations that have been found indispensable also for rebalancing scenarios between the tourism and road traffic pressures on the coast and the decline of inner areas, creating opportunities for synergic and sustainable interactions based on the enhancement of places and sustainable goals defined at National and International level (SNAI, 2013; SNSVS, 2017). This proposal represents, first of all, a contribution for the reflection and experimentation on multi-scalar and non-sectorial approaches to mobility interventions, taking into account the main problems

Fig. 7
The regeneration of the station of San Vito Trasbordo and the railway line. (Author: C. Amato).

Fig. 8
The regeneration of the railway line toward San Vito Chietino. (Author: C. Amato).

(environmental vulnerability, technical issues, infrastructural heritage, relations with large infrastructures) and at the same time the considerable opportunities (regional and national accessibility nodes, cultural paths, historical urban landscape) of fragile territories. (Fig. 8)

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