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VALDIVIA – REFINING ITS MOBILITY

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THEME: Modelling and Methodological Development

Abstract

The city centre of Valdivia, Región de los Rios, Chile, is suffering different consequences of the inadequate conditions of its public space and traffic system. Especially the poor infrastructure in order to connect the inner parts of the city culminating in the absence of a second bridge crossing Valdivias central river Calle Calle towards the Teja Island and the increasing motorized private transport is causing debilitating traffic jams during the daily busy hours while other zones in the city centre of potential public, recreational and commercial interest still remain as "junk space" waiting for their activation.

APPRENTICESHIP. Concering the "mobility of the southern chilenean city" Valdivia and its public space is one subject during this years urban design project class at the Architecture and Urbanism School, Universidad Austral de Chile. Giving an introduction of Space Syntax to the students we are aiming to provide not only an efficient analysis method but also a scientific tool of control during the urban design process.

SPACIAL ANALYSIS. Together with the students of urbanism we are going to interpret the results of our analysis based on the SPACE SYNTAX METHOD, discovering "errors" in the existing street system, which cause the problems of todays, traffic jams, prior- ranking of private transport, and the damage of public space of the city of Valdivia.

CASE STUDY: NEW BRIDGE OVER CALLE CALLE- RIVER, VALDIVIA. As a result of that students work we are going to do a CASE STUDY attempting to evaluate and to model different scenarios of possible locations of the new bridge crossing Valdivias Calle Calle River towards the Teja Island, in addition verifying the possibility of other investment related to existing forms of transport and to new variables that until now have not been included yet within the administrative process of decission- making. Therefor using the Space Syntx Analysis we will be able to SIMULATE the accordant CONSEQUENCES not only in terms of the benefits- cost relation but also implications that affect the ENVIRONMENT and its POLLUTION, the BUILT and NATURAL HERITAGE and its conservation and therefor the collective memory too, the image of the city in terms of the uniqueness of its urban landscape, the ACCESIBILITY of public and cultural services, like green spaces or public facilities.

PUBLIC PARTICIPATION. Once found and chosen the best solution Space Syntx will help us to underline the best proposal, trying to enrich the public discussion and to inform the responsible authorities permitting an objective desicion towards a refinement of the urban design process of Valdivia and an effective, research-based public investment.

CONTEXT

This proposal was planned to be an academic exercise, incorporating urban variables like integration in the manner of exploring a certain methodology to evaluate the different scenarios of investment which affect directly planification and urban design of a town.

This was realized with the help of a specific and nowadays case (of actual political and public debate) – how to improve the connection between two parts of a city by a new bridge over "Valdivia River" in the city with the same name.

The theme which contains the exercise is the relationship between the urban units inside the city through its movility, questioning the manner in which decisions of „materialization" are taken, which leaves apart a great number of dimensions which affect directly the quality of urban life.

VALDIVIA WITHIN A NATIONAL CONTEXT

The city of Valdivia (39º 48´S, 73º14´O) is the capital of the region "Región de los Rios" in Chile. Its population exceeds 140.000 inhabitants. Valdivia is part of the group of medium sized cities of Chile, which its populations ranging from 100.000 to 300.000 inhabitants (MINVU, 2008), different to the great metropolitan ACCLOMERATIONS which are inhabited by the 48,3% of all the Chileans. Those medium sized cities represent interesting urban schemes to study phenomenas like the mobility, because of its high possibility of improvement or transformation of its deficits, because of its physical size in which they develop themselves as well for the scale of its institutions, which are both often handable.

Valdiva was founded on the banks of its equally named river and left its footprints since its first mentioning in 1552. The river has been the first channel of communication, commerce and exchange. Its impressive geographical character gives him a certain isolation together with its scenic qualities and its international ecologic recognition. The development of the inner parts of the city produced that they „turned their backs" towards the river and nowadays the city holds highly caracteristical and recognizable zones. Although despite of its medium and accessibal size, its pieces and quarters found themselves disconnected and many of them with high deterioration.

TRANSIT VS MOBILITY

The movility plays a key roll within the development of the city, representing a potential for the improvement of life quality in the way how it is going to be understood and designed further than a pure "ingeneering" of traffic.

Movility is that one, which reaches connectivity together with accesibility and integration, is that one which recognizes the different possible and friendly ways of communication which permit the exchange and developement of the citizens, furthermore to the communication or the movement of goods and services.

The planning of the urban transportation within the Chilean cities is principally developed by master plans, which put their emphasis in realization of constructions of infrastructure and traffic systems which normally aim the improvement of connectivity (SECTRA). They are managed by the Secretary of Transport Planning

(SECTRA), authority at a center level in coordination with the local government (GORE), and implemented by public services and their local representatives (MINVU- MOP). Within the medium sized cities they are working together with land use and projects committees (SECTRA).

The local transportation plan of Valdivia (PTU) dates to the year of 1996 and was updated successively until a new version was presented in 2009. In the studies of origin – destiny that approved the actualization of its data base stands out the primacy of use of public transport (37,6%) as the principal way of transportation, a 21% would be realized individually (SECTRA 2003), although respective to the last one there can be noticed an increase during the last years.

The feasibility studies of improvement of connectivity between city centre and Teja Island began in 2009 and have been presented with the aim of its approval before the authorities and involved stakeholders (professional representations and public services) since 2010 but still the discussion and questioning of its results keeps on going.

What we present below is the modelling of multiple alternatives for the placing of a new bridge, which improves the connectivity between city core and the Tja Island as well as the city's "integration" and decreases congestion, contrary to the two alternatives recently presented to the community.

CASE STUDY: NEW BRIDGE OVER VALDIVIA- RIVER, VALDIVIA

THE SITUATION

The city centre of Valdivia is suffering different consequences of the inadequate conditions of its public space and traffic system. Especially the poor infrastructure in order to connect the inner parts of the city culminating in the absence of a second bridge crossing Valdivia's central river towards the Teja Island and the increasing motorized private transport is causing debilitating traffic jams during the daily busy hours while other zones in the city centre of potential public, recreational and commercial interest still remain as "junk space" waiting for their activation.

WHAT WE DID

We used the concepts of and CHOICE1 and INTEGRATION2 of Hillier and its THEORY OF NATURAL MOVEMENT and applied them within the modelling and analysis to understand the configuration of the city's system of public space and its movement flows, as Hillier points out *"... that the configuration of the urban street network, which is the largest spatial pattern in the city, is in and of itself a key determinant of movement flows and so co-presence in space. … We call it the theory of natural movement*." (Hillier, and Vaughan, 2007:6)

1. According to Hillier CHOICE is "*the measure of through-movement potential assesses the degree to which each space lies on simplest or shortest paths between all pairs of spaces in the system. In syntax this is called the choice measure*" (Hillier, and Vaughan, 2007:7)

2. "*The measure of accessibility for to-movement of a space is our INTEGRATION measure*" (Hillier, and Vaughan, 2007:7) or "... *the measure of relative asymmetry generalizes this by comparing how deep the*

system is from a particular point with how deep or shallow it theoretically could be – the least depth existing when all spaces are directly connected to the original space, and the most when all spaces are arranged in a unilinear sequence away from the original space, i.e. every additional space in the system adds one more level of depth." (Hillier and Hanson, 1984:108)

To reduce traffic concentration on the only existing bridge crossing from the city centre to the Teja Island, the "Ministerio de Obras Públicas" and the local government as executing and administrating instances of the city have been looking for an appropriate location of a possible second bridge. BUT HOW TO FIND THAT LOCATION WHICH HAS THE POWER TO REALLY RELEIVE THE ONLY EXISTING BRIDGE? AND EVEN: HOW TO ESTIMATE FUTURE TRAFFIC VOLUMES AND, ACCORDINGLY, ITS EFFECTIVITY OF THE ENTIRE SYSTEM THAT WAS CHANGED BY ADDING A NEW BRIDGE?

Having in mind those questions we took up that discussion and decided to do a CASE STUDY on where to place the second bridge, checking ALMOST ALL POSSIBLE LOCATIONS between Valdivias city centre, respectively the "Barrios Bajos", and the Teja Island (primarily regardless its feasibility): Handrawing an axial map of the area and incorporating the different bridges we were able to analyze in EACH CASE the following efficiency- relevant values using Space Syntax's Depth Map Software:

AVERAGE global THROUGH MOVEMENT POTENTIAL of each street system
MAXIMUM global THROUGH MOVEMENT POTENTIAL of each street system
AVERAGE GLOBAL INTEGRATION of each street system
AND: How changes the GLOBAL THROUGH MOVEMENT POTENTIAL on the existing bridge "Pedro de Valdivia" within each scenario's street system?

To reduce traffic concentration on the existing bridge "Pedro de Valdivia" and to improve Valdivia's AVERAGE GLOBAL INEGRATION we looked for the scenario/ case with:

the smallest global THROUGH MOVEMENT POTENTIAL ON THE EXISITING BRIDGE "Pedro de Valdivia" with coincidental high AVERAGE GLOBAL INTEGRATION VALUE of Valdivia's total street system.

MODELLING SCENARIOS

The figures we can see below represent the modelling of the different possible scenarios: The first figure represents the actual situation of the street system as a hand drawn axial map of Valdivia's Teja Island and the centre area on the right hand side of the bridge. The second shows the most important actual traffic volumes. Then follow an overview of all the possible bridges/ scenarios, an illustration of the actual global THROUGH MOVEMENT POTENTIALS of the existing street system's situation and the illustration of global THROUGH MOVEMENT POTENTIALS varying through the different samples/ scenarios including the governmental preferred alternatives of a north side or south side "Pedro de Valdivia"- Double- Bridge.

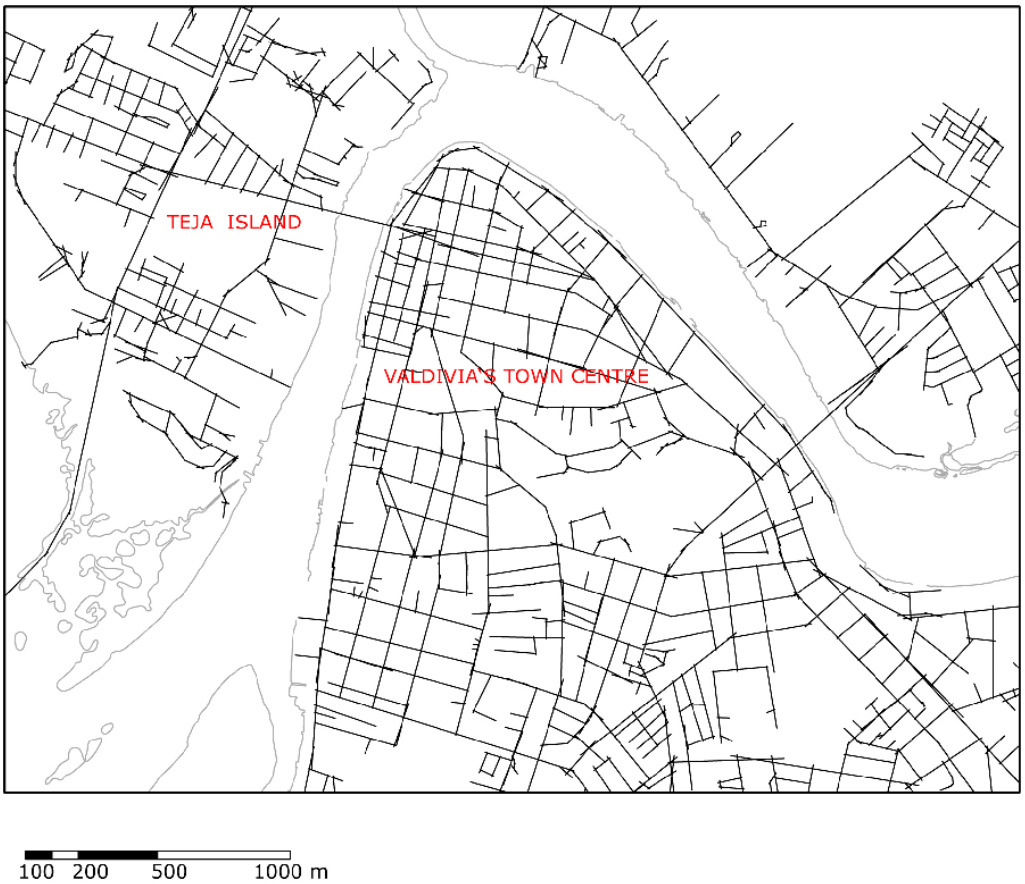


Figure 1. Situation of the existing street system (HANDDRAWN axial map), our spacial analysis base map.

Clearly recognizable – the only existing and on peak hours collapsing connection between Teja Island and the city centre.

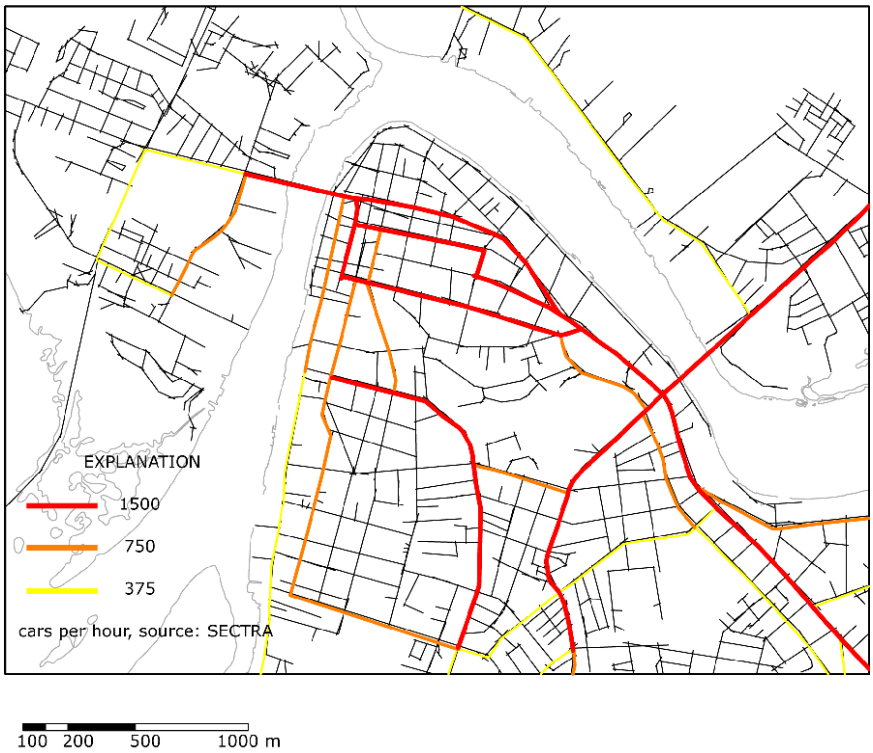


Figure 2. Traffic volumes per hour. Source: SECTRA

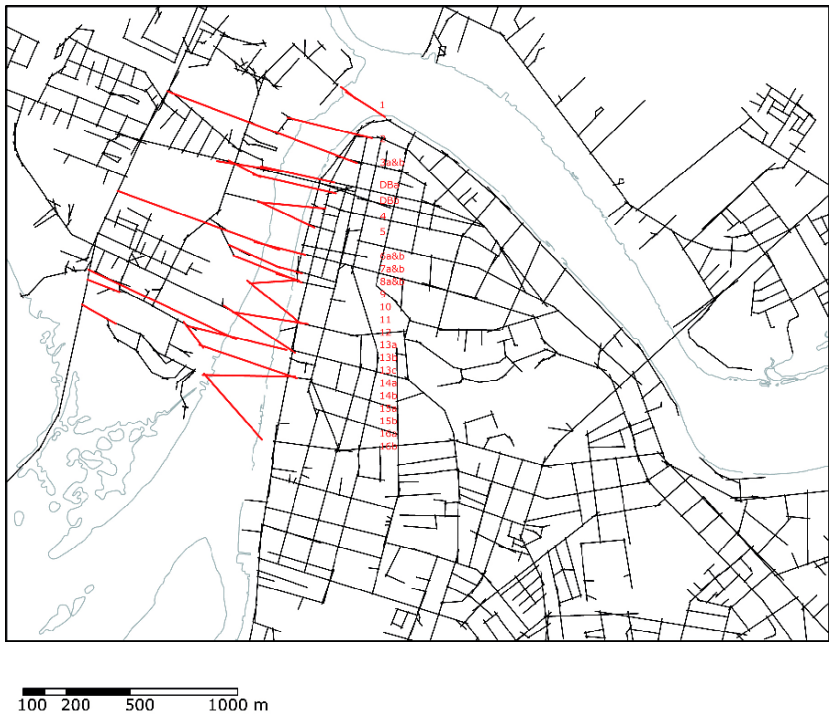


Figure 3. Different locations of possible bridges – the cases/ scenarios
(In some cases (b and c cases) the new bridges have been extended with connecting streets.)

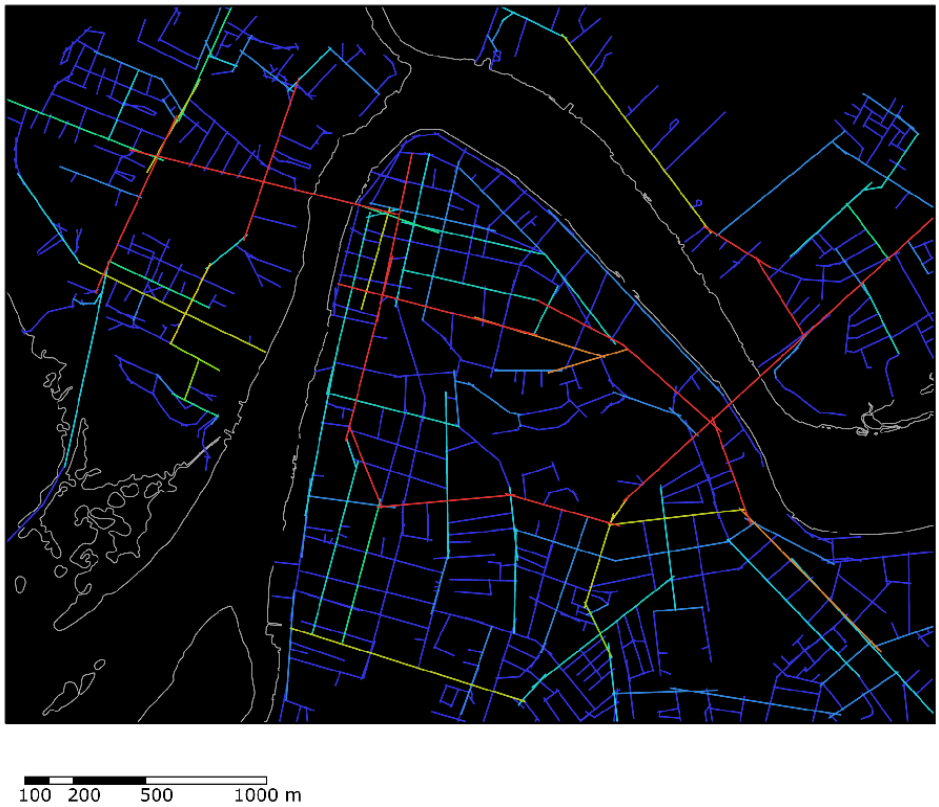
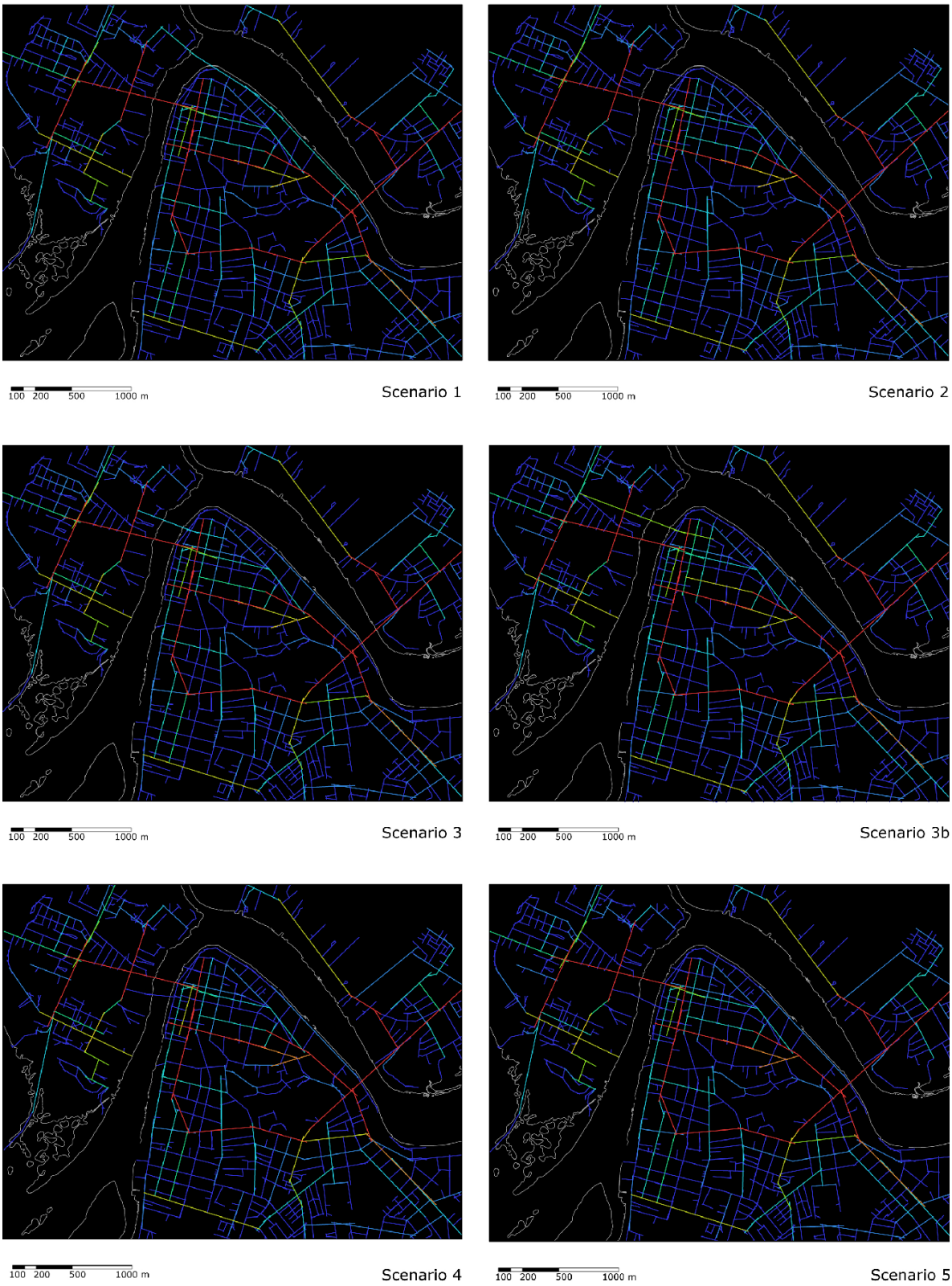


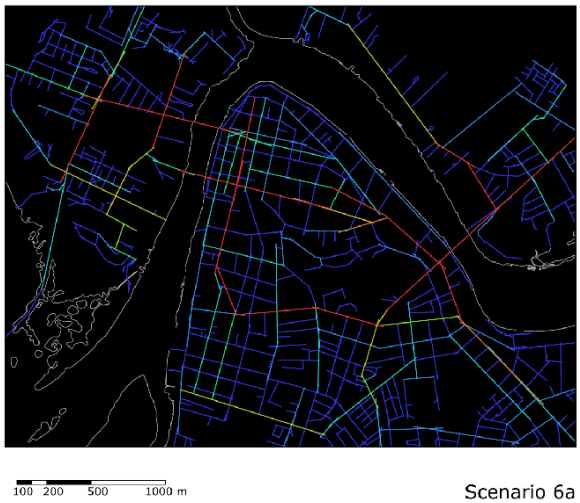
Figure 4. illustration of GLOBAL CHOICE values (through movement potential) of the EXISTING street system.

The bridge "Pedro de Valdivia" has the highest THROUGH MOVEMENT POTENTIAL of all the system (CHOICE existing bridge = MAX. CHOICE = 208.067, see table below.)

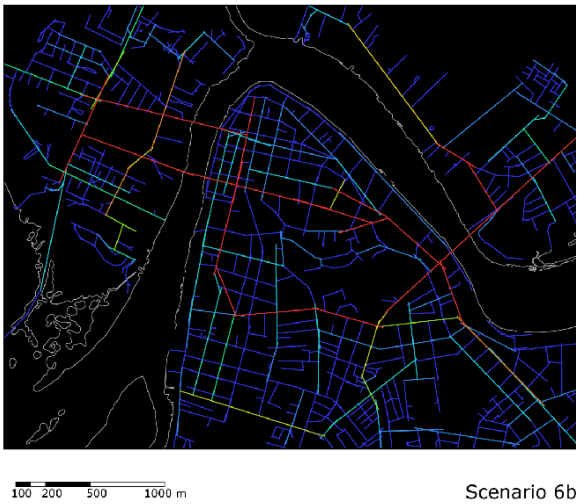
Illustration of CHANGING GLOBAL CHOICE values (through movement potentials) of the CASES/ SCENARIOS of possible locations of the new bridge crossing Valdivia River towards the Teja Island:



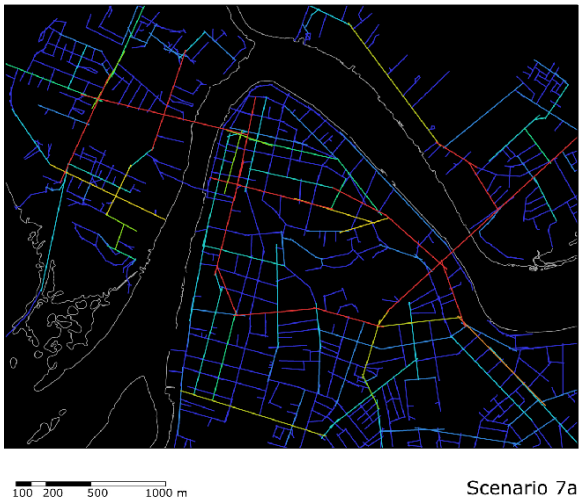
Figures 5. to 10. Modeling scenarios 1 to 5.



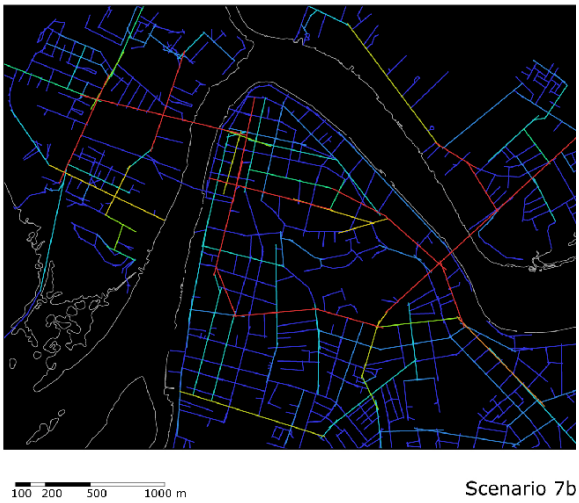
Scenario 6a



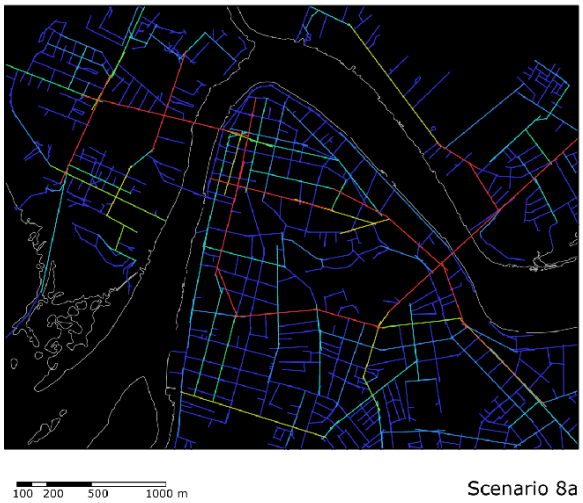
Scenario 6b



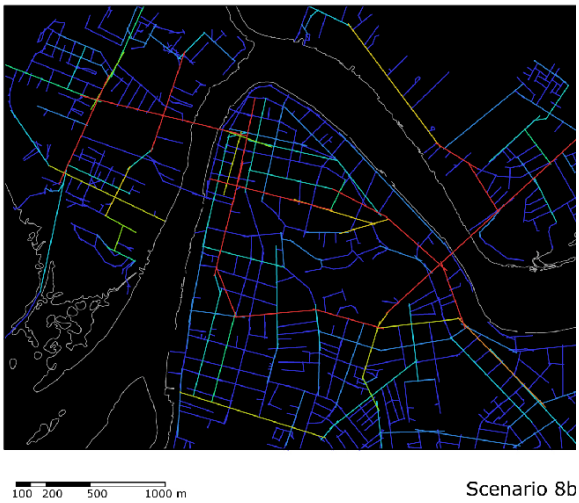
Scenario 7a



Scenario 7b



Scenario 8a



Scenario 8b

Figures 11. to 16. Modeling scenarios 6 to 8b.

100 200 500 1000 m

Scenario 9

100 200 500 1000 m

Scenario 10

100 200 500 1000 m

Scenario 11

100 200 500 1000 m

Scenario 12

100 200 500 1000 m

Scenario 13a

100 200 500 1000 m

Scenario 13b

Figures 17. to 22. Modeling scenarios 9 to 13b.

100 200 500 1000 m

Scenario 14a

100 200 500 1000 m

Scenario 14b

100 200 500 1000 m

Scenario 15a

100 200 500 1000 m

Scenario 15b

100 200 500 1000 m

Scenario 16a

100 200 500 1000 m

Scenario 16b

Figures 23. to 28. Modeling scenarios 14a to 16b.

By city government preferred cases of a so called “Pedro de Valdivia Double Bridge” (cases “Double Bridge North Side and South Side”):

100 200 500 1000 m

100 200 500 1000 m

Figures 29. and 30. Double Bridges “Pedro de Valdivia”, north side and south side

The differences of all the cases illustrates the following table, looking for the smallest GLOBAL THROUGH MOVEMENT POTENTIAL on existing bridge “Pedro de Valdivia” and a high average integration value for the entire system.

Maximum GLOBAL CHOICE values of the entire scenarios, its respective GLOBAL CHOICE values of the existing bridge “Pedro de Valdivia” and AVERAGE INTEGRATION of the existing street system and different scenarios:

Scenario	Max. choice	Choice existing Bridge	Aver. Integration (HH)
Existing street system	208067	208067	0,892668
Scenario 01	191500	191500	0,89765
Scenario 02	203675	203675	0,890689
Scenario 03	193212	193212	0,89379
Scenario 03b	172642	172642	0,896918
Scenario 04	204415	204415	0,89372
Scenario 05	207972	207972	0,89314
Scenario 06	181896	181896	0,898776
Scenario 06b	151958	107807	0,913653
Scenario 07	204981	204981	0,894534
Scenario 07b	204998	204998	0,89505
Scenario 08	204856	204856	0,894766
Scenario 08b	204379	204379	0,895436
Scenario 09	179971	179971	0,898225
Scenario 10	159744	159744	0,907125
Scenario 11	151618	133054	0,914911
Scenario 12	152476	129532	0,917329
Scenario 13	151315	129322	0,923905
Scenario 13b	151341	143510	0,919574
Scenario 13c	151076	144755	0,925886
Scenario 14	176640	176640	0,907156
Scenario 14b	177897	177897	0,908375
Scenario 15	180880	180880	0,92017
Scenario 15b	183062	183062	0,922414
Scenario 16	177696	177696	0,923114
Scenario 16b	179141	179141	0,925703
Double Bridge North Side	189041	189041	0,896483
Double Bridge South Side	161336	161336	0,904787

Table 1. Max. choice, global choice on existing bridge and entire system's average integration value.

What we can see in the table above is that ONLY IN SIX CASES (SCENARIOS 6b, 11, 12, 13a, 13b, 13c: marked green) the “Pedro de Valdivia” bridge's THROUGH MOVEMENT POTENTIAL is LOWER than the HIGHEST OCCURING THROUGH MOVEMENT POTENTIAL (MAX. CHOICE) within the entire system, respectively:

On the EXISTING BRIDGE “Pedro de Valdivia” occurs in almost all the cases/ scenarios STILL the system's HIGHEST THROUGH MOVEMENT POTENTIAL! (EXCEPT the cases 6b, 11, 12, 13a, 13b, 13c: marked green).

As well the two by the cities government proposed cases of a type of “double bridge” - apparently duplicating the existing bridges performance – (cases “Double Bridge North Side and South Side”) don't achieve a significant decline of “Pedro de Valdivia's THROUGH MOVEMENT POTENTIAL)!

Those cases 6b, 11, 12, 13a, 13b and 13c, marked green, as well coincide with the system's highest AVERAGE INTEGRATION VALUES (like as well cases 15a, 15b, 16a, 16b), which means the system's best average “to movement potentials”.

Scenario 6b, 11, 12 and 13a stand out with the existing bridge's LOWEST CHOICE VALUES of all the cases, whereat case 6b has the lowest of all the values (107.807).

The most feasible scenarios are the cases 11 & 12 (case 6b and case 13a need street extensions), where at CASE 12 has better values of GLOBAL THROUGH MOVEMENT POTENTIAL on existing bridge “Pedro de Valdivia” and as well better average integration.

CONCLUSION

We can propose the CASE 12, which means a feasible bridge between the streets LORD CHOCHRANE and LOS PELUES, standing out with the consequence of a significant reduction of “Pedro de Valdivia's” THROUGH MOVEMENT POTENTIAL EVEN BELOW THE SYSTEM'S MAXIMUM and an improvement of Valdivia's street system's average integration.

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