

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

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Studio	
Name / Theme	Complex Cities Studio
Teachers / tutors	1st mentor // Arie Romein 2nd mentor // Leo van den Burg
Argumentation of choice of the studio	The main motivation for joining the research group is the interest in exploring city development through regional planning, by understanding the dynamics of the built environment and exploring the range and influence of stakeholders, later combining the knowledge into strategies for improving the territory. The direct link with the studio would be with the inclusive cities graduation topic. As the description says, the research aims to tackle urbanisation issues and challenges in the global south. Topics such as rapid urban growth; inadequate governance & weak institutional capacity; environmental sustainability; and social & economic integration will be discussed throughout the research project.

Graduation project	
Title of the graduation project	Altamira beyond Belo Monte <i>Gaps and opportunities for promoting sustainable development in a new energy landscape</i>
Goal	
Location:	Altamira - Para - Brazil
The posed problem,	The research focuses in the city of Altamira , in Brazil. The municipality is located in the margins of the Xingu river, affluent of the Amazon river, and has been facing intense socio economic transformations, mainly through the construction of the Belo Monte hydroelectric power plant - third biggest in the world, in generation capacity. Over the last 10 years, the local municipality estimates that the population inflated from 100.000 to 140.000 inhabitants (FOLHA, 2013), as a consequence of the jobs related to the dam and its construction. On the one hand, the implementation of the project has brought heavy investments in public infrastructure, following the compensation and mitigation guidelines established by the national environmental agency, providing the inhabitants with public amenities completely nonexistent before the dam. On the other hand, the intense transformation of the built environment resulted in new social challenges, including increased violence, prostitution and drug consumption, adding pressure on the limited infrastructure and public equipments. The project -

heavily criticized by local and international media - is almost concluded and is already in partial operation. This research aims to investigate the next steps following the conclusion of the construction, searching for strategies capable of promoting sustainable development in the region. The focus is not only to look into the urban transformations triggered by the installation of the dam but also to explore possible future scenarios once Belo Monte is concluded.

Dams, reservoirs, roads, mining sites, ports, among others, are essential infrastructure required for economic development, not only in Brazil but in other (developing) countries around the globe (Cernea, 1997). And besides its global values, such infrastructures are also expected to encourage local socio-economic development, by bringing investments, jobs, and resources to the region in which they are implemented (Frantál et al., 2014). Nonetheless, when considering their magnitude, there is a significant range of impacts associated with its construction, directly influencing the development of urban landscapes hosting or surrounding these mega projects (see Cernea, 1997; Égré and Sénécal, 2003; Tilt et al., 2009; Moran, 2016). The graduation thesis explores the knowledge and experiences on urban development and socio economic implications when constructing big infrastructure projects, often in remote and fragile regions. The general scope, however, is not to evaluate the necessity, efficiency and impacts for conceiving this type of infrastructure, but to understand the spatial transformations the construction might bring to surrounding cities and the influence they may have in social networks of local communities. In a planning perspective, the research discusses the potentialities and challenges of urban landscapes subjected to the influence of big infrastructure, looking not only to the actual situation but also to scenarios of future developments and opportunities.

There is usually a large potential for economic growth and sustainable development associated with the construction of big infrastructure. But unless the social and environmental impacts are properly addressed and mitigated through explicit policy, legislation, and financial resources, conceiving such projects is likely to result in negative impacts in the affected communities. A successful implementation relies not only on social sensitive planning and strategies but also in effective institutions, capable of translating mitigation and development plans into successful actions on the ground (CERNEA, 1997).

By analyzing recent transformation in Altamira, it becomes clear that the main changes in the structure of the city were consolidated due to the variety of impacts associated to the construction of the hydropower plant and the consequent compensation and mitigation programs. The transformations, enforced by the PBA (*basic environmental plan*), were very significant, with extensive investments in roads, bridges, water and waste collection and treatment, schools, and hospitals, besides the 6 new residential neighborhoods designed to accommodate the directly affected population. However, beyond the provision of the required equipments and infrastructure, the dam is also responsible for triggering a new dynamic of development in the municipality. A new dynamic capable of encouraging future socio-spatial transformations in Altamira, even after the conclusion of the dam.

	<p>Even when considering a successful consolidation of the compensation guidelines, there is still much uncertainty while discussing possible futures in Altamira. The diversity of outcomes vary according to the effectiveness of the programs created, the capability of the public institutions, the operation of the plant, the settlement of affected population and workforce, the economic development of the region, future migrations or even an eventual population decrease, following the reduction of job opportunities after the conclusion of the dam. These uncertainties both influence and are influenced by the built environment and current development policies, which raises further concerns about the municipality, especially when considering the delicate characteristics of its preserved landscape.</p> <p>Furthermore, since the beginning of the construction, most of the interventions in public infrastructure that took place in Altamira only became feasible due to financial resources coming from the dam. Aside from the discussion of what has and has not been yet fulfilled, the interventions made in the urban fabric were - and still are - dependent on the construction consortium and the Norte Energia group. Once the guidelines are completed, Norte Energia will no longer be responsible for maintaining many of the programs created, shifting the operation to local government, and the investments in public equipments will come to an end. And with the reduced efforts from the construction consortium, Altamira will eventually have to test its resilience, seeking to integrate the future uncertainties surrounding the development of its urban fabric and social networks.</p> <p>The outcomes the region city might have will depend on how well the resources provided by Norte Energia to the community are used to produce lasting improvements in the local economy (Moran, 2016). The management of these resources, however, becomes one of the main challenges not only in Altamira but in the whole region, especially when considering the fragility public institutions have.</p>
<p>research questions and</p>	<p>There is a strong relationship between the construction of the Belo Monte hydropower plant and the current development dynamic in Altamira. This symbiosis raises many questions and concerns regarding past and future developments in the region. The aim, however, is not to enter the debate on the severity of the impacts or to question whether hydroelectric dams should or should not be built. The aim is to understand the main implications of its construction on the built environment and to explore possible gaps and opportunities of future development in the municipality.</p> <p>Is the current dynamic of development, promoted by the construction of the Belo Monte dam and mitigation guidelines, resulting in a resilient model for Altamira, capable of promoting sustainable development and how can strategies and policies be used to further explore the economic potential generated, stimulating growth while minimizing possible risks?</p>

design assignment in which these result.

There are two main objectives for the research project:

1. [research and investigate]

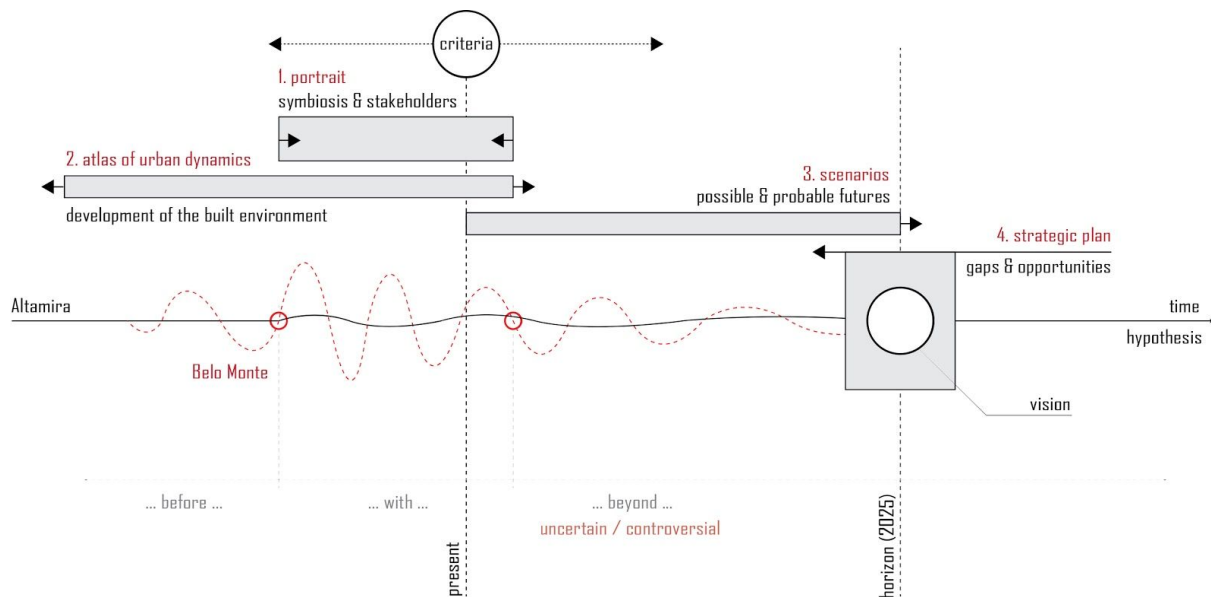
Identification of the current dynamics shaping the city of Altamira, through different analytical methodologies, looking for the understanding of its morphology and processes, by acknowledging all the multiple layers involved in the development of its built environment. This study is meant to provide an insight of the existing relationship between the construction of a major infrastructure and the changes it has promoted in the development of the municipality. Furthermore, considering all the uncertainties surrounding the project, this study is also intended for the extrapolation of probable futures, resulting in different scenarios for the municipality and investigating the possible outcomes, once the construction of the dam is concluded.

2. [evaluate and design]

Creation of a strategic plan, capable of guiding future development in the municipality, by exploring the different scenarios created. The strategies aim to identify gaps and opportunities to be acknowledged in plans and policies, in order to take better advantage of the investments generated and challenges to be addressed, recognizing the unique risks and potentialities for developing this sensible region.

Process

Method description



The research aims at different moments of the formation of Altamira, in relation to the implementation of the dam:
before: focuses in the development of the city until the beginning of the construction of the Belo Monte hydropower plant;
with: investigates the relationship and symbiosis between the city dynamics and construction of the project; and
after: is explores possible futures for the city, analyzing a series of key factors influencing transformations in the built environment.

The research methodology was organized according to different moments of Altamira, framing the products according to the different periods, as shown in the diagram above. The sub questions, products, methods and tools adopted are described in this chapter of the thesis.

SUB QUESTIONS AND PRODUCTS

To answer different sub questions raised, some research and design methods are adopted, resulting into four different outputs. The products are namely (i) an atlas of city development; (ii) a portrait of Altamira; (iii) scenarios of development; and (iv) a strategic plan. The products, methods and tools used for this outcome are described in this section of the research:

RQ1. What are the historical processes and how are the existing plans & policies shaping the development of Altamira?

RQ2. What are the main socio-spatial transformations promoted by the construction of the Belo Monte dam?

i. Atlas of urban dynamics [*development of the built environment*]:

The atlas consists of an investigation of the spatial characteristics of the built environment of Altamira. The atlas is the output of different analysis tools, used to understand and communicate the dynamic of the urban fabric of the city. It is an exercise for understanding existing networks, movements, plans, and the spatial configuration and is a fundamental process for the development of other outputs of the research. It explores the territory of Altamira through time, from its early occupation, to the extraction of latex, the opening of the Transamazonica highway and recently, the construction of the Belo Monte dam.

RQ3. How is the project and its construction perceived by the inhabitants of Altamira and main stakeholders involved?

ii. Portrait [*symbiosis*]:

A portrait is a design exercise, intended as an analysis method for the urban landscape of Altamira. Within different perspectives and controversy surrounding the recent history of the city, this method was chosen **to portray** the transformation processes in Altamira. The portrait goes beyond mapping of the visible layers of the city, by exploring design methodologies trying to introduce different perspectives. Considering the vastness of discussions, the portrait aims to represent Altamira after the construction of the hydropower plant acknowledging many opposing opinions surrounding its development.

Within the scope of study [*representation of an object or scene by colors or lines, or by words*], **to portray** emphasizes the faithful representation. [*thesaurus*]

RQ4: What are the key factors and variables shaping the development of the built environment of Altamira, after the conclusion of the dam?

RQ5: What future socio-spatial variations could be expected to influence the development of the built environment of Altamira?

iii. Scenarios of development [*possible & probable future*]:

Considering the strong dynamism of the municipality, due to the radical transformations in recent history, there is still much uncertainty regarding several factors that might influence future developments of Altamira. In this regard, scenarios are employed aiming to create a variety of future-oriented constructions of the most relevant key factors. In here, scenarios intend to raise relevant questions rather than providing solutions. The approach explores the extrapolation of trends, resulting in a set of possible and probable futures, acknowledging different outcomes instead of a single one.

RQ6: What are the main threats and opportunities surrounding future scenarios of development in Altamira?

RQ7: How can a design-based methodology be used to better explore the economic potential generated and minimize the risk of further socio-economic impacts?

iv. Strategic plan [gaps & opportunities]:

The product of the scenario creation can then be used to investigate the critical points regarding current development trends and to revise the existing policies guiding it. This exercise allows the creation of a set of strategies capable of stirring the development towards an envisioned future. The strategic plan consist of a series of suggestions, in form of programs, projects and policies, aiming the promotion of sustainable development in Altamira, regardless of the different outcomes or scenarios.

METHODS AND TOOLS:

To answer the questions and come up with the envisaged outputs, the different methods and tools are described below. The methods, divided into research and design oriented approaches, are (i) literature review; (ii) site visit; (iii) spatial analysis; (iv) scenario building; and (v) strategic planning. The division, however, does not mean the research has a linear process. The methods are overlapping and complementary, having several methods supporting the elaboration of each output.

i. Literature review:

It is the starting point and a constant process throughout the research. Divided into policy review, historical review and theory review

→ Policy

The expected impacts of the implementation of the dam as well as the necessary actions and policies to cope with that have already been meticulously discussed. It is vital to understand the policies that are shaping the development of the region, in order to explore different approaches to accommodate possible changes and the levels of governance to do so. Current policies include the PBA (Basic Environmental Project) and the city's master plan.

→ History

Looking not only into literature explaining the formation process of the region, but also into recent reports and news regarding the construction of the Belo Monte hydropower plant.

→ Theory

The exploration of the problem field. Discussions on the variety of impacts consequent to the construction of dams are no new subject and much knowledge has already been written about it. Through existing literature the thesis looks for a general understanding of the problem in hand, exploring and evaluating the main risks and benefits through reports and case studies on existing projects.

ii. Site visit:

"Who comes from outside has an image from Altamira, always completely transformed after a visit"
Maria Gomes, employee of Norte Energia, during the visit to the UHE Belo Monte

It is fundamental for the understanding of the urban dynamics and transformations to experience the site. Especially when considering the controversy surrounding the construction of the dam and the vastness of reports and researches realized in Altamira. A close contact with the inhabitants of the city and their perception of their city can also be helpful to get an reliable input, beyond the main actors discussing the transformations. A few different tools can be used for a fruitful site visit, described below:

→ Participant observation

The main part of a field trip is observing the city and its dynamics in persons. Experiencing the built environment in and user perspective is vital for a reliable spatial analysis and strategy for future development.

→ Specialist / Expert Interview

The project, since its conception, was very polemic. Throughout the process there was the involvement and participation of many different groups, resulting in a strong polarization of opinions. Furthermore, much research has already been done in the range of impacts and transformations promoted by the construction of the dam. The

expert interviews tries to (1) understand the different groups, their opinions and arguments regarding the construction of the dam; (2) gather data and information regarding the whole process; (3) investigate different risks and potentials according to different stakeholders, both directly and indirectly engaged with the project; and (4) understanding the dynamic of actors and existing polarization, grasping the discussion and problem field surrounding the implementation of the project. The selected groups included Norte Energia, the NGOs (ISA), the municipality (secretary of planning and construction / infrastructure); UFPA (federal university); the commercial association (ACIAPA); and the PDRSX committee.

→ **Quick surveys with local population**

But simply talking with the main stakeholders does not represent the general perception and reaction the implementation of the Belo Monte hydropower plant. The survey with the population is intended to understand how the transformations are seen and how were they accepted by the population. Furthermore, when designing a strategic plan, the main concerns and expectations of the population should be addressed. In this regard, the survey also investigate the main risks and potentialities, in the eyes of the affected population. Questions include:

1. Origin and time of residence
2. How do you see the implementation of the dam? Positive or negative?
3. What do you appreciate the most after the construction of the dam? Best improvement?
4. What concerns / upsets you the most?
5. What do you think needs to be improved or changed in the future? If you were the mayor...

The surveys are not intended to have a quantitative purpose. They are simply a series of testimonials, trying to illustrate the general feeling inhabitants have towards recent socio-spatial transformations

→ **Networking**

It is a reminder that the field trip is short and not everything will be able to be solved. A good networking ensures that a good connection is established with all different groups, maintaining the door opened for further doubts or interviews. Networking can also be vital for additional data collection.

iii. Spatial Analysis:

Identification and drawing of the different layers of the city, to gain a better understanding of spatial, environmental and social conditions of the current and past urban fabrics. The tools are also useful to illustrate ideas and findings and communicate them in a clear and efficient way. The layers to be mapped were defined according to the criteria established for the scenarios and are later used for the construction exercise:

→ **Mapping**

- a. *Natural Landscape and Growth*
- b. *Infrastructure and Expansion (roads and mobility; waste and water; housing)*
- c. *Health and Education (public equipment and infrastructure)*
- d. *Jobs and Income (commercial areas, economic activities)*
- e. *Population and Public Life*
- f. *Public Resources and Finances*

→ **Photographic rehearsal**

The photographic rehearsal, made during the field trip, is used also used for spatial analysis, visualization and deeper understanding of the typo morphological formation of the built environment of Altamira. Photographies are also a strong communicative tool.

iv. Scenario Building

Facing several uncertainties concerning the development of Altamira, future oriented techniques have no 'true' claim to reality as such, rather, scenarios aid to supply a hypothetical construct of possible and probable outcomes on the basis of knowledge on the past and present (Kosow and Gassner, 2007). But there is a wide range of scenario building methodologies, varying according to different goals and functions. For this master thesis, scenarios are adopted for its *explorative and strategy formation functions*, aiming to further investigate the current dynamics of the city by extrapolating a series of key factors, later using the results to support the

decision-making process. Scenarios also have a strong *communicative function*, which could be a powerful tool for aligning different stakeholders.

→ **Criteria identification**

Criteria identification implies the definition of key factors influencing future development of Altamira. Those are variables, parameters, trends, developments and events which will be explored during the course of the process (Kosow and Gassner, 2007). The criteria are defined through the policy and theory review, looking into possible impacts promoted by the construction of big infrastructure; and a precedent study, investigating the process of other similar projects in the Amazonian region.

→ **Analysis**

The analysis process explores different outcomes according to the criteria defined. Its methodology is similar to the spatial analysis, but now experimenting extrapolations on key factors identified, trying to envision future developments. To aid the analysis, comparative studies are used to orient probable variations of the most relevant indicators.

→ **Scenario generation**

The scenario generation is the construct of possible futures. It is a design exercise, projecting the knowledge of the analytical process into a series of hypothetical visions of the future.

v. Strategic Planning

The numerous different scenarios created can be compared with one another, illustrating possibilities of developments and highlighting consequences of extrapolations of key factors and policies, facilitating the decision-making process. In this regard, scenarios are used to test the reliability, robustness, and effectiveness of current municipal policies and mitigation / compensation programs (Kosow and Gassner, 2007). This knowledge is then used for defining a series of guidelines, programs and strategies, exploring potentialities identified and minimizing possible risks, leading towards the sustainable development of Altamira.

→ **Evaluation**

First step is the evaluation of the outcomes of the scenario building exercise. A SWOT analysis is used for the identification of main gaps and opportunities concerning possible futures. The criteria allow for a focus in the relevant topics for the research

→ **Vision**

The vision allows the creation of a desirable future, having a *goal-setting function*. The vision is established according to the knowledge on the dynamics of socio-spatial configuration of Altamira. Expert interviews and surveys with the population are also considered for the definition of an ideal scenario.

→ **Guidelines & Programs**

It is the strategic plan. Elaboration of strategies and programs capable of directing the development of Altamira towards the envisioned future. Scenarios are considered for optimizing the master plan, acknowledging a series of possible future.

Literature and general practical preference

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Reflection

Relevance

i. Scientific

The construction of big infrastructure projects in remote regions is very frequent in many countries around the world and the discussion of its impacts in fragile urban ecologies is fundamental for the assurance of the quality of life of the affected communities and preservation of the natural landscape. For the discipline of Regional and Urban Planning, topics including workforce migration, resettlement of affected population, population growth, city expansion, social and spatial justice among others, have a vital importance for the understanding of the selected and similar sites.

Furthermore, the symbiosis between Altamira and the Belo Monte dam offers a unique opportunity to study how interventions and transformations associated with the construction big infrastructure projects, government policies and the resulting development can impact the daily life of neglected communities, affecting their households, jobs and social structures.

Also, despite the main interest in exploring city development is through regional planning, the research scrutinizes different analysis methodologies, introducing design as part of the process. This approach might contribute to a different perspective within the disciplinary body of knowledge.

ii. Societal

The aim is to explore the inevitable development of a remote region of Brazil, accelerated by the construction of a large-scale infrastructure project. From the challenges faced by the affected and migrant population to the fragile management of the public institutions, the research raises a series of relevant topics for the investigation of such urban landscape, common not only in Brazil but worldwide.

The expected outcome is a set of guidelines able to help to detect and diagnosis the fragilities and opportunities of the process and contribute to future urban planning and policies. Besides that, the project deals with a protected landscape, currently under pressure for its natural resources. If not planned, the socio spatial impacts described might increase this pressure by stimulating unorganized urban growth and territorial occupation. The development in such region must be very cautious, aligned with activities and policies capable of protecting the natural habitat and its local communities.

iii. Ethical

Being born in Brazil, abundant with natural resources and hydric potential, the topic of big infrastructure is present my DNA. Beyond the usual urbanism topics, the research engages in discussions such as the exploration of natural resources, preservation of the Amazonian forest, respect to the indigenous communities and rights, national and regional policies, among others, relevant to my formation as a Brazilian and World citizen. The graduation thesis is intended not only as an exploration of relevant topic to the field of study, but also as a discussion on the pursuit of sustainable development and social justice in a developing country, exploring its natural resources without abusing its' magnificent landscape.

Time planning

Methodology & Products	P1	P2	P3	P4	P5
	sep. to nov. 2017	nov. to jan. 2018	feb. to april 2018	april to may 2018	may & june 2018

Methodos



Products

