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Engineering as a Pillar of Development: The Strategic Role of Public Infrastructure in Brazil

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SUMMARY

This article analyzes the fundamental role of engineering in the execution and maintenance of public infrastructure in Brazil, considering its economic, social, and environmental relevance. With a humanized and critical approach, the study presents current data on public investments, challenges faced by engineers in the management of public works, and the direct impact of these structures on the population's quality of life. A bibliographic review is used based on authors such as Tavares (2021), Silva and Cunha (2020), and guidelines from agencies such as IBGE and the Ministry of Infrastructure. It is concluded that engineering, when acting in line with social responsibility, is one of the pillars for sustainable and equitable development.

Keywords: Civil engineering; Public infrastructure; Public policies; Urban development; Sustainability.

1. INTRODUCTION

Engineering has historically been one of the most important vectors of a nation's social and economic progress. In Brazil, where issues such as social inequality, rapid urbanization and lack of basic services are recurrent, public infrastructure represents more than concrete and steel — it represents **access, dignity and the future.**

According to the Ministry of Infrastructure (2023), **the basic sanitation deficit affects around 35 million Brazilians,** while **more than 45% of federal roads are in poor or very poor condition,** according to the National Transport Confederation (CNT, 2022). These figures reveal not only logistical failures, but also problems in public health, mobility and citizenship.

This article proposes a reflection on the role of engineering in public infrastructure, its ethical responsibility and the challenges that professionals in the field face when building for the collective.

2. THEORETICAL FRAMEWORK

According to Tavares (2021), public engineering is responsible for translating public policies into tangible structures that shape the daily lives of cities and the countryside.
For Silva and Cunha (2020), it is necessary to rethink traditional models of public projects, incorporating practices of sustainability, innovation and social listening.

The 1988 Federal Constitution establishes the State's duty to guarantee adequate infrastructure to the population (BRAZIL, 1988). This includes sanitation, transportation, housing and energy, all of which depend on engineering works and actions.

Furthermore, Law No. 14,133/2021, known as the **New Bidding and Contracts Law,** brings significant changes to the contracting of public works, requiring greater technical planning and environmental responsibility on the part of engineers.

3. METHODOLOGY

This work is based on **a bibliographic review** and **documentary analysis** of official data. Sources such as the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Infrastructure, the Federal Court of Auditors (TCU) and scientific articles indexed in databases such as Scielo and Google Scholar were used. The humanized and accessible language aims to bring technical knowledge closer to society in general.

4. PUBLIC INFRASTRUCTURE AS A SOCIAL RIGHT

Public infrastructure is the set of services and facilities essential to the functioning of society, such as roads, bridges, viaducts, sewage systems, water supply, public lighting, schools and hospitals. The absence or precariousness of these structures directly compromises the right to the city and human dignity.

According to the IBGE (2022), **only 55% of Brazilian households are connected to treated sewage systems.** In the North and Northeast regions, this rate is even lower. This data reveals a structural problem that affects, above all, the most vulnerable populations.

Engineering, in this context, is not just execution: it is **strategic planning with human impact.**

5. CHALLENGES IN INFRASTRUCTURE MANAGEMENT

Among the main challenges faced by engineers in public works are:

- **Insufficient or poorly planned budgets**
- **Excessive bureaucracy**
- **Lack of technical training in city halls and states**
- **Corruption and fraud in bidding processes**
- **Political discontinuity**

According to a TCU report (2023), **more than 14 thousand public works are paralyzed in Brazil,** which represents around R$26 billion in unused or compromised public resources.

Additionally, many engineers face pressure to accelerate schedules without compromising quality—something that requires not just technical skill, but **ethical leadership.**

6. THE ENGINEER AS AN AGENT OF SOCIAL TRANSFORMATION

More than designers, engineers must be **mediators between the State and society.** They deal with direct impacts on public health, urban mobility, security and the economy.

As Porto (2019) highlights, “the 21st century engineer needs to have, in addition to technical mastery, a sensitive eye for the social realities in which his work is inserted”.

This humanized vision of engineering requires active listening, commitment to technical truth, and openness to innovative solutions — such as the use of **green technologies, BIM modeling,** and **participatory urban planning processes.**

7. PERSPECTIVES FOR THE FUTURE

The new National Logistics Plan (PNL 2035), prepared by the Federal Government, foresees **investments of more than R$500 billion in infrastructure by 2035,** prioritizing railways, ports and sanitation (MINFRA, 2023). This represents opportunities and also responsibilities for national engineering.

The training of more conscientious engineers, with professional ethics and a systemic vision, is crucial. Universities, regional councils and regulatory bodies play an essential role in this process.

8. FINAL CONSIDERATIONS

Public engineering is a noble and strategic field for Brazil. Building bridges, schools, hospitals and sanitation networks is building dignity. In this process, the engineer is an **agent of citizenship.**

It is urgent and necessary that urban planning, public governance and technical implementation go hand in hand. Engineers must be the protagonists of an infrastructure that respects humans, values the territory and honors public investment.

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