

# A ROUTE TOWARDS SUSTAINABLE TRANSPORT IN SOUTH AFRICA

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## ABSTRACT

Over the last 30 years the South African transport fraternity was to some extent overwhelmed by transport acts, policy white papers, strategies, various studies and the development of integrated transport plans at provincial and municipal spheres of government. The latter recommended numerous projects of which only a few materialised in practice. The implementation of these policies, strategies and plans, or actually the lack thereof, didn't really contribute materially to the vision that transport is the heartbeat of South Africa's economic growth and social development. Also, it did not lead to the development of integrated and efficient transport systems.

The paper postulates that transport in South Africa does not have the right "DNA" and suggests a route towards sustainable transportation for South Africa by 2030. The "route" is described in the paper by means of:

- The definition and ideal DNA composition of sustainable transport;
- Proposed direction to connect the vision and objectives with strategic actions which are required to achieve sustainable transport; and
- Identification of possible "roadblocks" along the route and "construction" that may be needed to arrive at the destination.

## 1. BACKGROUND

Until the late seventies South Africa's transport policy and legislative framework was predominately determined by commissions of inquiry into specific transport matters such as road motor transport (J C Le Roux Commission, 1929) and urban transport (the Driessen Committee, 1974). The National Transport Policy Study (NTPS) that was undertaken in the early eighties was probably the first "modern-day" transport planning study in South Africa. The purpose of the NTPS was to investigate and formulate recommendations towards a revised transport policy which would be in line with the country's national policy. It also formed the basis of the 1986 White Paper on National Transport Policy in 1986.

Since 1986, various policies and strategies were formulated to promote and integrate transport in South Africa. Pockets of excellence, such as the Gautrain, certain airports, national roads and few bus rapid transit services have been developed, but a coherent, integrated master plan for a sustainable transport system is still lacking.

This is probably due to policies and strategies that have been implemented partially or not at all, but also because transportation in South Africa suffers from a damaged DNA.

The methodology followed in researching this paper was to briefly describe the human DNA and to propose an “ideal” transportation DNA in order to identify the disabilities of the current transport system and to propose a “route” towards sustainable transportation for South Africa by 2030. The overarching recommendation of the paper is that it would be advisable to create a new sustainable transportation environment.

## 2. PROPOSED TRANSPORTATION DNA THEORY

### 2.1 Introduction

All human beings contain the molecular instructions for life, called deoxyribonucleic acid or DNA. The DNA is a molecule that carries most of the genetic instructions used in the development, functioning and reproduction of all known living organisms. Encoded within this DNA are the directions for traits as diverse as the colour of a person's eyes or hair colour. The DNA of the human body is described briefly (in layman's language) in the following paragraphs.

### 2.2 DNA of the Human Body

The human body consists of cells (estimated at 100 trillion). They are the “Building Blocks of Life”. Each cell has its own job, just like humans. Cells are “told” what to do by the DNA molecule which contains a record of instructions to tell the cell what its job is. These instructions come from the genes which are a segment of the DNA. Genes are like recipes or instruction manuals for the human body. Genes are also the molecular units of heredity.

The DNA molecule consists of two strands coiled around each other to form a double helix with the backbone spiralling around the outside and the base pairs pointing inwards (refer to Figure 1).

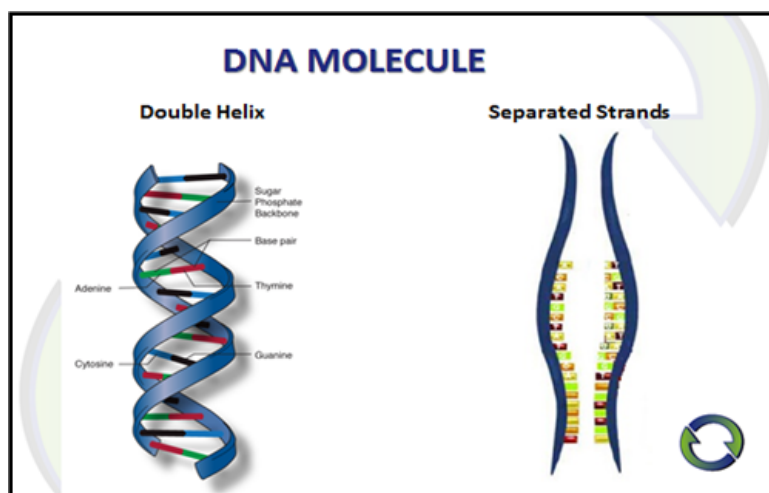
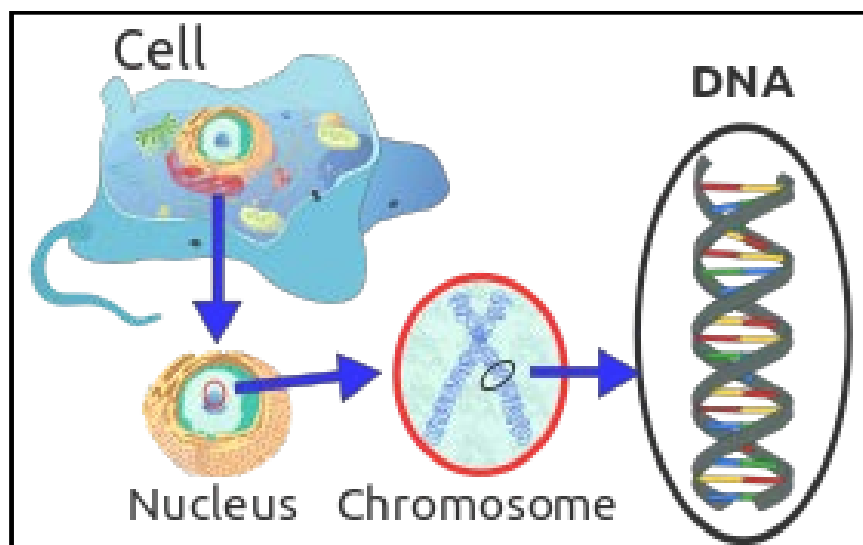


Figure 1: DNA Double Helix and Strands

The double helix of the complete DNA molecule resembles a spiral staircase, with two backbones and the paired bases in the centre of the helix which resemble the steps of a ladder.

The DNA is located in the cell nucleus (refer to Figure 2). Most cells are incredibly small and to fit the DNA (the strands are almost 2m long when straightened) within one of these cells a process known as DNA Packaging is used to compact the DNA into a form dense enough to fit into the cell nucleus. The compacted DNA is kept tightly wrapped in chromosomes which are located inside the nucleus of the cells. Chromosomes are thread-like structures which consist of long strands of DNA containing thousands of genes.



**Figure 2: Cell Nucleus and Chromosome**

The DNA of the human body is much more complex than what was presented in the previous paragraphs. The DNAs, genes and the chromosomes all work together with the 200 cell types to enable a human being to live a full life. There is more happening underneath the skin of the body than what meets the eye. This is also true of transportation. Transportation is more than just vehicles and infrastructure. It also consists of “invisible” or intangible aspects such as policy, safety, security, social inclusion, marketing and communication.

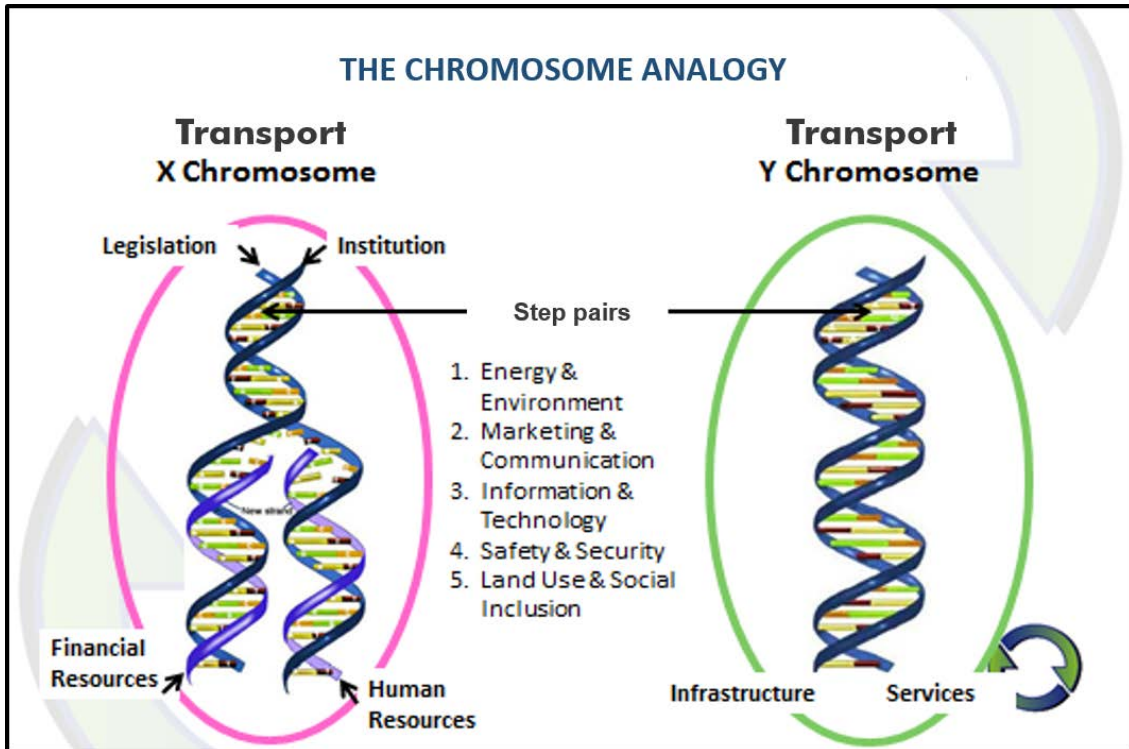
### **2.3 Proposed Transportation DNA Theory**

The Transportation DNA theory is based on the biological DNA molecule and encodes the culture, vision, strategy, values and purpose of transportation. Analogous to the human DNA it is proposed that the Transportation DNA should consist of:

- Cells: In the transport milieu the cells resemble the transport authorities or Transport Bodies. The national and provincial Departments of Transport or the Transport Divisions of the seven Metropolitan Municipalities are regarded as the cells of South Africa’s Transportation DNA;
- Strands:
  - The legislation and Institutional structures together with the human and financial resources are the “strands” which form the two double helixes of

the DNA molecule in the Transportation X-Chromosome (refer to Figure 3);

- The transport infrastructure and services are the “strands” of the DNA molecule which form the double helix of the Transportation Y-Chromosome (refer to Figure 3).



**Figure 3: The Transportation Chromosome Analogy**

- Step Pairs: The step pairs are ancillary to the Transportation X- and Y-Chromosomes. Without them the transportation system can operate, but not sustainably. Transportation issues related to step pairs must be accommodated in all transportation planning projects and the implementation and operations of such projects. The step pairs are:
  - Energy and Environmental issues;
  - Information and Technology issues;
  - Land use and Social Inclusion matters;
  - Marketing and Communication aspects; and
  - Safety and Security aspects.
- Genes: The DNA contains a record of instructions to “tell” the cell what its job is. These instructions come from the genes which form a segment of the DNA. Genes are like recipes or instruction manuals. Essential transportation genes are such as:
  - Transportation vision, values and sense of purpose;
  - Transportation policy and strategy;
  - Transportation regulations;
  - Political statements of intent (e.g. the National Development Plan);
  - Knowledge management and a well-structured skills transfer programme;
  - Transmission of corporate culture to employees at all levels;
  - Entrance of new employees with new ideas;

- Effective planning, design, construction, maintenance and operational teams (for infrastructure and services);
- Clear procedures and structures which are enforced rigorously;
- Regular research initiatives to stay abreast with best practices and trends; and
- Continuous performance measurement of the transportation system.

The X-Chromosome resembles the head of the human body and the Y-Chromosome resembles the heart and lungs. The Step Pairs resemble the limbs of the human body.

### **3. DISABILITIES OF SOUTH AFRICA'S TRANSPORTATION DNA**

#### **3.1 Introduction**

Damage to the human DNA can occur as a result of an alteration in the chemical structure of DNA, such as a break in a strand of DNA, a base missing from the backbone of DNA, or a chemically changed base. Most DNA damages can undergo DNA repair, but such repair is not 100% efficient. Unrepaired DNA damages accumulate in non-replicating cells, such as cells in the brains or muscles of adult human beings and can cause aging. In replicating cells past damages in the strands of the DNA can give rise to alterations. These alterations can change gene function or regulation of gene expression and possibly contribute to progression to cancer.

Disabilities of the transportation DNA will harm transport users' quality of life and will impair economic growth. It is therefore of paramount importance that the disabilities of the transportation DNA be identified and repaired timeously, or even better, be prevented from occurring. Some of the most commonly transportation DNA disabilities in South Africa since 1910 to 1986 and from 1986 to 2016 are highlighted in the following paragraphs.

The sections below describe the "roadblocks" on the route towards a sustainable transport system.

#### **3.2 Transportation Disabilities pre 1986**

As part of the political arrangements of South Africa becoming a Union in 1910, it was agreed that the Central Government will be responsible for rail transport and the provinces for road transport. From 1910 until 1977 transport "planning and policy" was commission-of-inquiry driven. As a result of this approach, transportation in South Africa contained damaged X- and Y-Chromosomes, no "official" Step Pairs and few essential transportation genes. Transportation of this period could be classified as either "brain-dead" or in a "wheel-chair".

### **3.3 Transportation Disabilities post 1986**

#### **3.3.1 Transport Authority Disabilities**

Together with the national and the nine provincial Departments of Transport and the Transport Divisions of the seven Metropolitan Municipalities, South Africa has 17 transport authorities without the numerous local authority Transport Authorities (TA). Integration and co-ordination of transport policy, infrastructure and services is almost impossible. The division of the four provinces into nine in 1994 resulted in five provinces with damaged transportation DNAs. These new provinces didn't really manage to "repair" that damage successfully. Many of the Metropolitan Municipalities are in a similar position.

On the surface it appears that most of the Transportation X- and Y- Chromosomes of the transport authorities are functioning properly. However, the statistics below paint a different picture:

- Freight logistics costs at 12.8% of GDP which is approximately 50% higher than in the USA and 20% higher than in Brazil(1);
- The condition of 30% of the national and provincial road network is in a poor and very poor condition(2);
- South Africans are spending an average of 10 working days a year stuck in traffic;
- Road traffic deaths in South Africa of 24.64/100 000 population is among the 37 highest in the world; and
- The economic cost of South Africa's road crashes is estimated at R 307 billion per annum.

The main disabilities of the transport authorities at provincial and local spheres of government are a lack of:

- Skills (=Knowledge + Experience + Wisdom);
- Implementation of their transport policies, strategies and plans; and
- Financing.

#### **3.3.2 Step Pair Disabilities**

A serious disability at many transport authorities is the fact that most of the Step Pairs do not figure in any of their transportation strategies, plans and projects. In terms of the biological DNA metaphor, this means that the transport authority has no, or only a few, limbs, acting similarly to a person. The transportation in such a transport authority can therefore be labelled as "wheelchair" transport.

#### **3.3.3 Gene Disabilities**

Some of the common gene disabilities are:

- Transportation policy, vision, strategy, values and corporate culture not transmitted to employees at all levels;
- Political statements of intent not considered during project planning and implementation;

- Lack of knowledge management and a well-structured skills transfer programme;
- No clear procedures and structures which are enforced rigorously;
- Not enough research funds to stay abreast with best practices and trends; and
- Lack of continuous performance measurement of the transportation system.

#### **4. PROPOSED ROUTE TOWARDS SUSTAINABLE TRANSPORTATION BY 2030**

##### **4.1 Introduction**

Sustainable Transport meets the current transport and mobility needs without compromising the ability of future generations to meet their own transport needs.

A more detailed definition, describes sustainable transportation that:

- Allows the basic access and development needs of individuals, companies and society to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations.
- Is affordable, operates fairly and efficiently, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development.
- Limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and uses non-renewable resources at or below the rates of development of renewable substitutes, while minimizing the impact on the use of land and the generation of noise.

The essence of this chapter deals with what should be done to reach sustainable transportation, or how to move away from the existing “disabled” situation, i.e. the “construction” that should take place to overcome the “roadblocks” on the route towards sustainable transport.

The year 2030 is an important year throughout the world. The resolution adopted on 25<sup>th</sup> September 2015 by the General Assembly of the United Nations, A/70/L.1, deals with Transforming our World: The 2030 Agenda for Sustainable Development<sup>(3)</sup>. The 17 Sustainable Development Goals and 169 targets announced in this resolution demonstrate the scale and ambition and reconfirmed a plan for people, the planet and prosperity.

Similarly, in 2012, The National Planning Commission of South Africa released the National Development Plan 2030 Our future – make it work<sup>(4)</sup>.

The “construction” activities described in this section, are classified in 5-year intervals to allow proper strategic planning and implementation. The proposed phases are:

- Phase A: 2015 to 2020;
- Phase B: 2020 to 2025; and
- Phase C: 2025 to 2030.

## **4.2 Transportation Codesa**

Without proper consultation and debate, the transport system in South Africa will remain unsustainable. The purpose of the debate – to be held over a number of sessions over a period of time – would be to set transport on a new sustainable path. This action is required similar to setting South Africa on a new democratic path in the early 1990's.

South Africa will not get world class economic growth without sustainable transport. "Breeding" of a new transport environment should commence that is sustainable, both financially and environmentally.

The objective of the Transport Codesa should be to construct a level playing field towards truly integrated transport in which all role-players will move towards one united vision and goal, namely sustainable transport by 2030 and be able to maintain that beyond 2030. At the Codesa, the Transport Bodies should be presented, among other the Department of Transport, Provincial Authorities, Metros and Municipal Authorities, Operators of transport services, Logistic companies, financiers and investors.

This activity needs to be started and completed in Phase A, year 1.

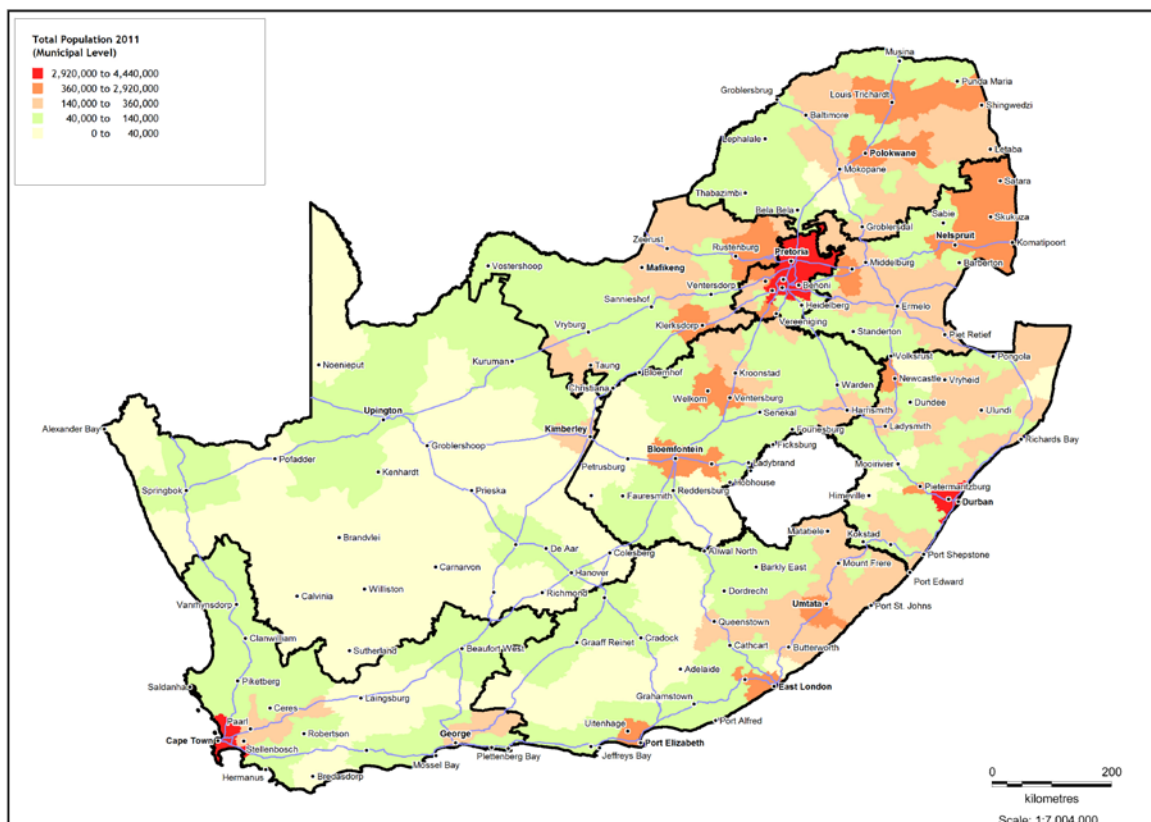
## **4.3 Doing a Detailed Assessment**

Considering the required functions that Transport Authorities has to fulfil from Section 11.(1)(c) of the NLTA<sup>(5)</sup>, it is clear that the posts required to comply with the requirements of the act are unlikely to be filled in the high number of TA's – see also section 3.3.1. Consolidation of the TA boundaries has to take place.

Assessing the demographics of South Africa, a restructuring of TA boundaries are recommended as presented in Figure 4 overleaf. Although clear boundaries are not drawn, the focus within an area should be based on mobility needs. The focus areas should be where the darker areas are on the map. Regional TAs should be established rather than adding the function of a TA automatically into that of each local authority.

Using the DNA analogy, assessment needs to start with the head, i.e. a proper "brain scan" has to be done, i.e. what skills are available and what would be required for that particular area.





**Figure 4: Potential Mobility Need Areas to be converted to Regionally Managed Transport Authorities**

This activity also needs to be started and completed in Phase A.

#### 4.4 Measure Performance of The Transport Body

Without performance measurement of Transport Authorities/Bodies, the current unsustainable situation will remain. Performance measures quantitatively report important matters about products, services and the processes that produce them. The saying “*To measure is to know*” is critical. A measuring tool will help to understand, manage, and improve what organizations do. Performance measures inform:

- How well the organisation is doing;
- If goals are met;
- If customers are satisfied;
- If processes are in statistical control; and
- If and where improvements are necessary.

A TA Performance Measuring Tool complying with the above, needs to be developed. An example of the outcome of such a tool may be as presented overleaf in Figure 5. This activity also needs to be started and completed in Phase A.

		X-Chromosomes	
		-	+
Y-Chromosomes & Step Pairs	+	<b>RUNNING ON EMPTY (B):</b> Movement still forward fuelled by pockets of excellence but implementation and accountability lacking	<b>FAST FORWARD (A):</b> Coherent Integrated Master Plan for Sustainable Transport
	-	<b>GRID LOCK (D):</b> Strategy is Unclear and Lack of Appropriate Investment in Infrastructure	<b>STALLING (C):</b> The right things have been done at the wrong time

Figure 5: Performance Management Reporting Example

#### 4.5 Building of Capacity using Available Experience

Experience cannot be taught. It is gained by doing. However it is possible to compress a lot of experience gained over a long time (in many cases a career of 40 plus years) into “virtual experience” (refer to Figure 6). This will make the inexperienced employees more productive sooner. They in fact get a “head-start” (Person B with skills transfer in Figure 6) in comparison with Person A, whom started from own knowledge and experience.

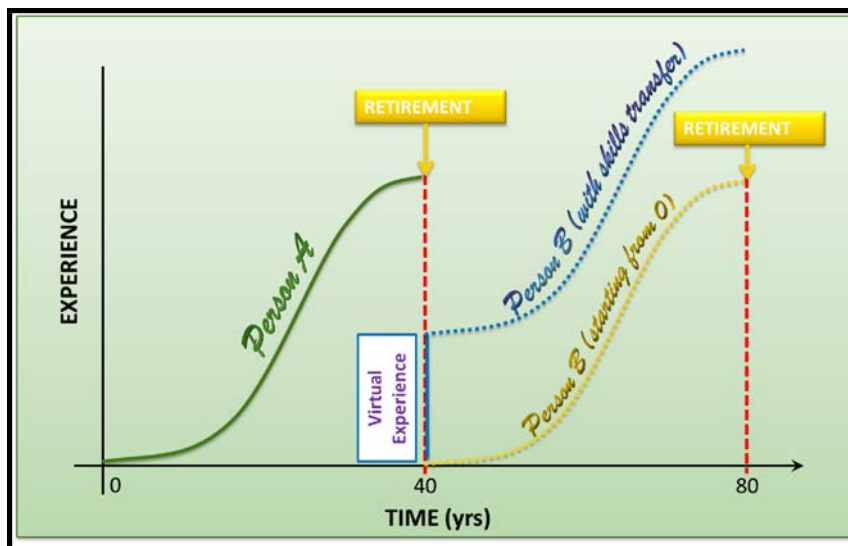


Figure 6: Diagrammatic illustration of virtual experience impact

This activity will follow directly after the assessment of the relevant TAs, also in Phase A.

## **4.6 Suggestions and Interpretations from the National Development Plan (NDP) 2030<sup>(5)</sup>**

The suggestions listed in sections 4.6.1 to 4.6.5 from the NDP, are part of the action steps suggested in this paper, to ensure sustainable transportation.

### **4.6.1 Prioritisation**

Transport decisions usually involve expensive, expansive systems that take years to build and are in place for decades. Given the financial and time commitment such decisions demand, it is important to carefully rank competing options using clear decision-making criteria. Focus should be on safety, affordability and efficiency rather than on trying to incorporate all transport options.

### **4.6.2 Focus on Transport as a System**

Instead of focusing on a particular transport mode, emphasis should be placed on the total transport network. This systemic approach will help improve transport efficiency and accessibility while reducing the overall environmental, social and economic costs. This approach should also consider transportation options that would contribute towards South Africa's decarbonisation efforts, for instance, the use of electric buses or offering companies incentives for using delivery vehicles powered by liquefied natural gas.

### **4.6.3 The Big Picture Approach**

Social and economic mobility does not necessarily depend on a transport system. Spatial planning – for example, establishing more economic opportunities where people live or creating new settlements close to work hubs – could also provide a solution. However, this is a long process. In the medium term, South Africa will probably continue to experience increasing traffic congestion.

### **4.6.4 Behavioural Change**

Behavioural change is critical for reducing the environmental, social and economic costs associated with transport. Targeted communications campaigns and the availability of alternatives have the potential to improve South Africa's transport situation by shifting public thinking about public transport and transport that uses alternative energy sources. For instance, while some forms of private transport, such as the car, will still be used in 2030, there will be a marked move towards public transport as more options become available to commuters.

## 5. CONCLUSIONS

The authors have introduced, but by no means refined, a theory for Transportation DNA. The proposed Transport DNA is at this stage put forward for debate and requires refinement but the authors suggest that it is a defensible one which could contribute to achieve sustainable transport in South Africa. They are of the opinion that using the human biological DNA metaphor, combined with a more detailed assessment of transportation needs within appropriate regional Transportation Authority boundaries, will lead towards sustainable transportation in South Africa.

The proposed Transport Codesa could facilitate levelling the playing field towards truly integrated transport in which all role-players will move towards one united vision and goal, namely sustainable transport by 2030.

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