# Digital Solutions for Enhanced Traffic Management in the Serengeti National Park

5 April 2022

Prepared by

Jan Coetzee Pr Eng
ITS

# Objectives of study as defined by KfW

1. Identify alternatives to improve traffic management

2. Formulate feasible options to increase effectiveness and efficiency of vehicular movement control in the parks.

3. Ensuring the long-term integrity of the Serengeti ecosystems.

4. Implementation of state-of-the-art information and communication technologies

# Methodology

# Road Network

## Internal Roads

Narrow road
(approximate area Kemariswe Hills)

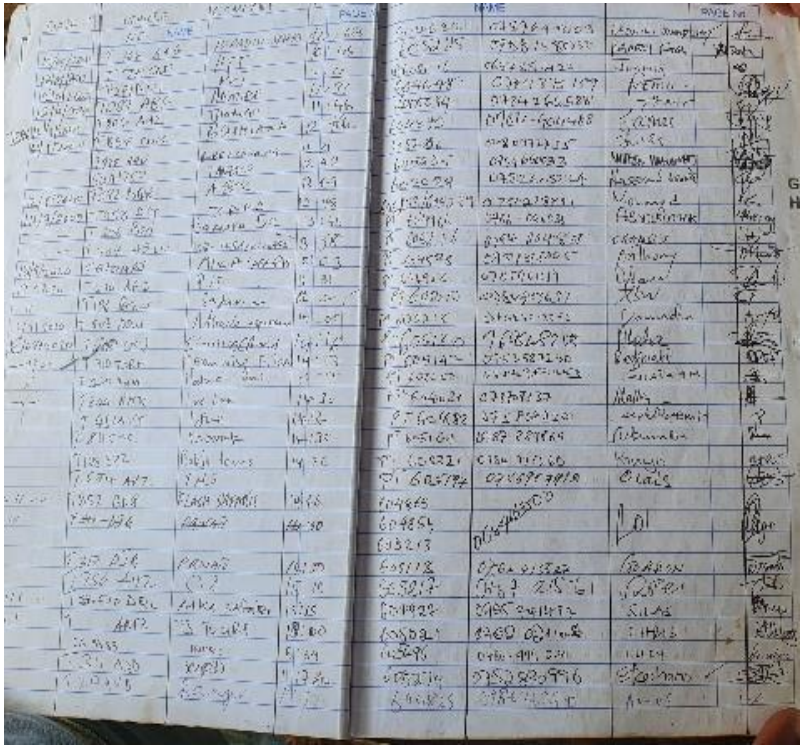
Low water bridge
to Grumeti airstrip and camp

# Gate Operations

## Naabi Gate

Ngorongoro Conservation Area exit / entry with next to it the Serengeti entry / exit area

Entry / exit books

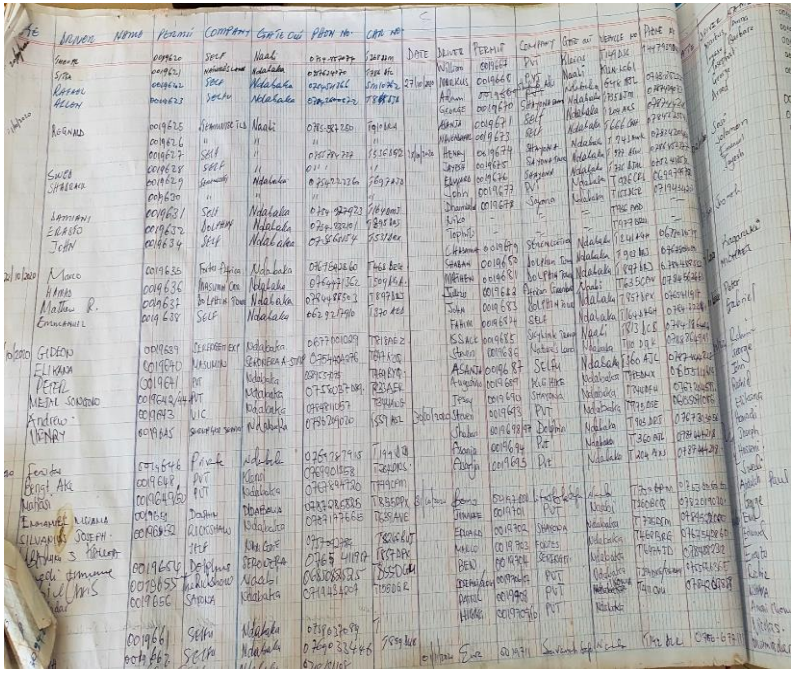


# Gate Operations

## Ndabaka Gate

Ndabaka Gate


Arrivals book



# Gate Operations

## Ikoma Gate

Ikoma Gate


Approach road to gate

# Traffic Demand Serengeti

| No | Description | Scenarios | | |
|---|---|---|---|---|
| | | Low | Medium | High |
| a | No beds - as per master plan | 14500 | 14500 | 14500 |
| b | % guests travelling at the same time | 65% | 75% | 90% |
| c | Average Capacity per vehicle | 12 | 10 | 8 |
| d | No of vehicles carrying tourists | 1208 | 1450 | 1813 |
| e | Tourist Vehicles on the roads at the same time, typically morning peak period, game viewing (b x d) | 785 | 1088 | 1631 |
| f | Average staff to tourist ratio, estimate (high end lodges will be 1:1 or more, cheaper lodges will be 0.3:1) | 60.0% | 65.0% | 70.0% |
| g | Number staff | 8700 | 9425 | 10150 |
| h | Average Capacity staff transport vehicles, persons | 30 | 25 | 20 |
| i | Percentage of staff daily commuting in/out of the park in peak period) | 20% | 25% | 35% |
| j | Estimate total Staff vehicles in peak period (g/h x i) | 58 | 94 | 178 |
| k | Through traffic / ranger vehicles / other in peak period, estimate based on verbal info from wardens | 50 | 75 | 100 |
| l | Total vehicles at same time travelling on all roads, peak period, morning peak period (e + j + k) | **893** | **1257** | **1909** |
| m | Total vehicles requiring tracking, estimate (d+j+k) | **1316** | **1619** | **2090** |

# Serengeti

# Traffic Problems

1. **Access control and monitoring**
   Visitor management, entry and exit at gates
   Logistic management (deliveries to camps and lodges).

2. **Speeding**

   Speeding - frequently occurs, No Enforcement

3. **Road adherence**

   Vehicles can drive where they want, and often drive off road.

4. **Crowding and congestion**

   Crowding occurs at animal sightings
   Congestion at the Cogatende / Mara river crossing in migration.

# Principles for Systems Design

1. The **wildlife and eco system must be protected** at all costs.

2. System should be **kept simple**, Fast, effective entry and exit – “No forms no fuss”

3. The **tourist experience must be optimized** , system must be “invisible” or “transparent” to the tourist.

4. "The **tourist as compliance officer**" – they must report bad driving

5. **Redundancy** - have duplicate electricity sources, duplicate communication systems for backup

6. The design life should be 20 years - “forever” - **SUSTAINABLE**

.

# Alternative Solutions

# Access Gates

| | |
|---|---|
| A1 | Record manually in paper the registration of vehicle, and passport / ID details of all visitors |
| A2 | Same as above, but type in details electronically |
| A3 | Scan the number plates, license disks and passports or Identification documents |
| A4 | Fingerprint registration for visitors |
| A5 | Facial recognition for visitors |
| A6 | Overview CCTV cameras to record vehicles and persons |
| A7 | Automatic Number plate recognition cameras at gates |

# Alternative Solutions

# Speeding

S1 Spot speed measurement using a laser- or radar device

S2 Average speed over distance (ASOD) using number plate recognition (ANPR)

S3 Installing an on-board unit that can be tracked using GPS and communication to download the tracking data to a central point

S4 ASOD using RFID tags

# Alternative Solutions

# Road Adherence

R1 More wardens with vehicles

R2 Education and awareness of tourists

R3 Vehicle Reporting mechanism

R4 Aerial surveillance using aircraft or drones

R5 On-board units with GPS and geofencing

# Alternative Solutions

# Crowding / Congestion

C1 More wardens with vehicles

C2 Education and awareness of tourists

C3 On-board units with GPS and geofencing

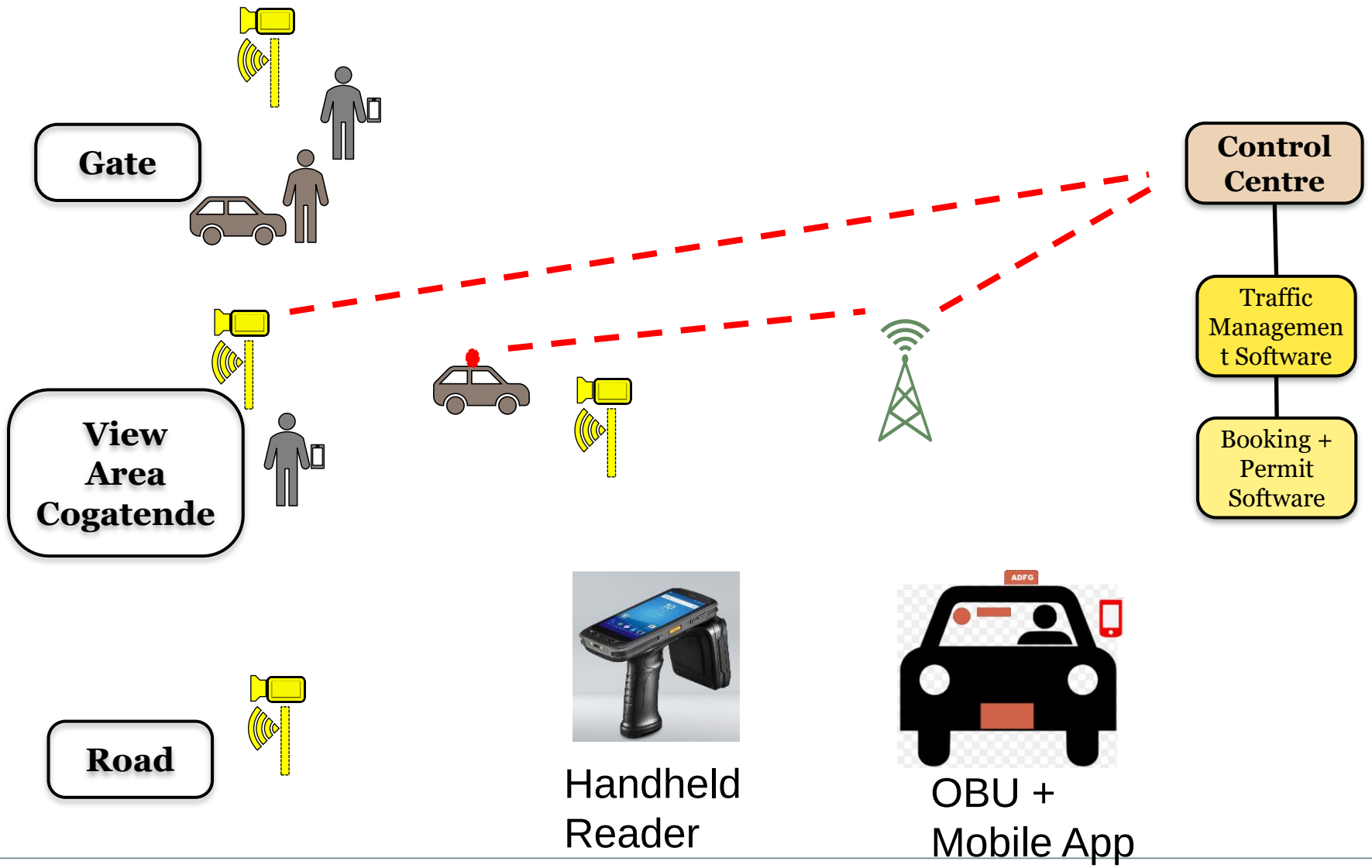
C4 Overview CCTV cameras at fixed locations

C5 Booking system and Time limits in certain areas

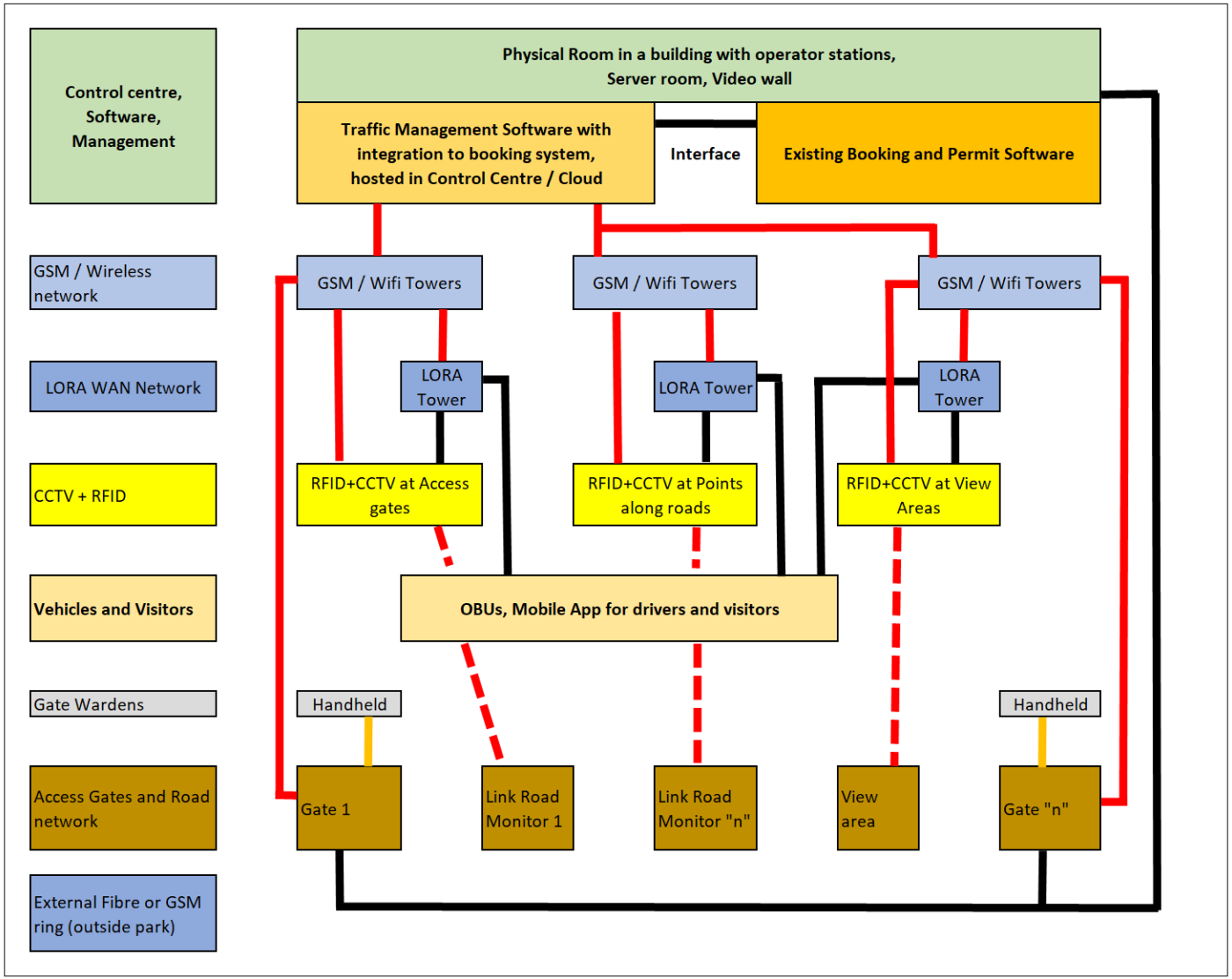
C6 Vehicle Reporting mechanism

C7 Aerial surveillance using aircraft or drones

# Proposed Solution



# Proposed Solution – Architecture

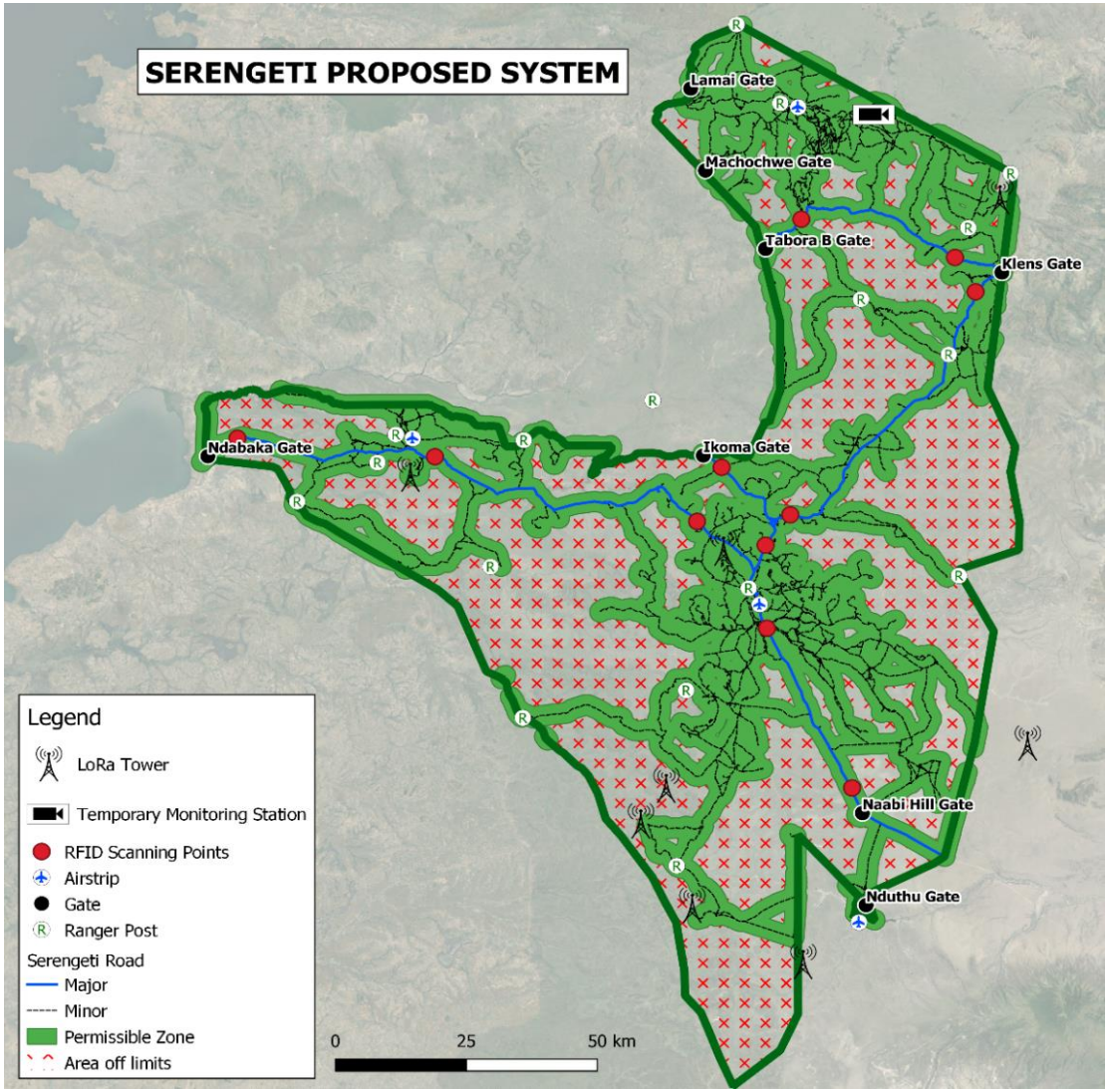


# Viewing Areas

# Congestion Management

# Spot vehicles along the roads

# Compliance monitoring



# Main Issues related to Tour Operators

1. On-board unit – on top of vehicle, inside
2. RFID tags in window
3. Registration of all passengers / persons at gate – entry / exit
4. Tracking and spotting of vehicles
5. Mobile application / communication
6. Evidence for transgressions – speeding, off-roading, congestion areas – Implement Fining / self regulation system
7. Cost implications – OBU, operational / communications cost
8. Reporting – monthly performance