



TANAPA TRAFFIC MANAGEMENT



Digital Solutions for Enhanced Traffic Management in the Serengeti National Park

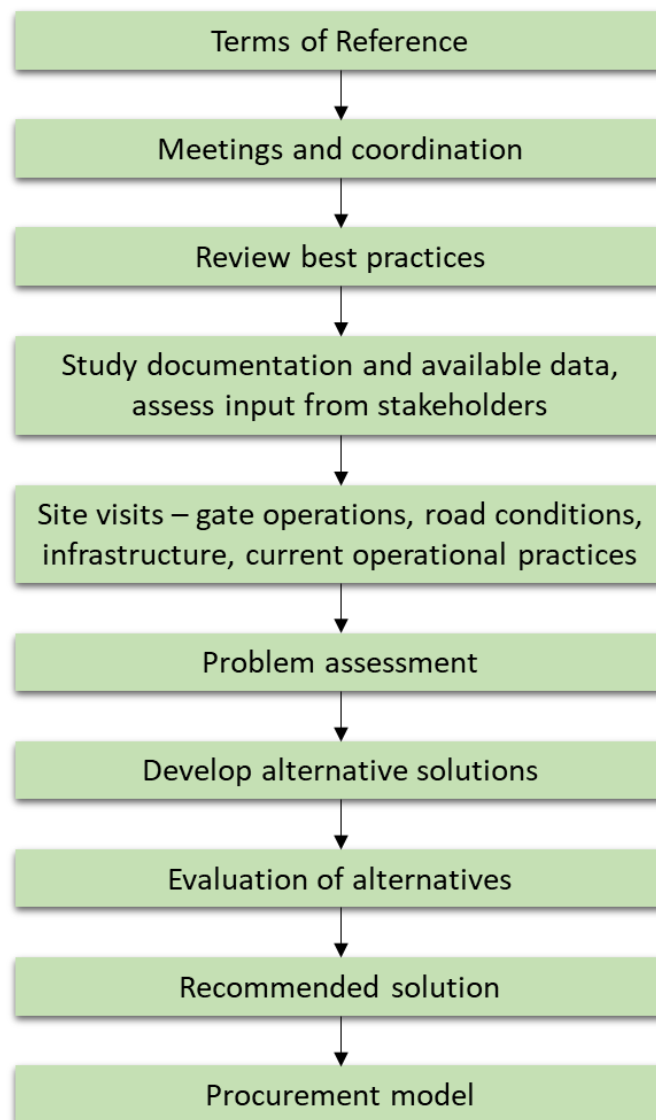
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Prepared by

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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



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

DATE	TIME	NAME	VEHICLE	TYPE	ENTRY	EXIT	REMARKS
2019-01-15	08:00	John Doe	Toyota Land Cruiser	4x4	08:00	08:15	First entry
2019-01-15	08:15	Jane Smith	Toyota Land Cruiser	4x4	08:15	08:30	Second entry
2019-01-15	08:30	Mike Johnson	Toyota Land Cruiser	4x4	08:30	08:45	Third entry
2019-01-15	08:45	Emily White	Toyota Land Cruiser	4x4	08:45	09:00	Fourth entry
2019-01-15	09:00	David Brown	Toyota Land Cruiser	4x4	09:00	09:15	Fifth entry
2019-01-15	09:15	Sarah Green	Toyota Land Cruiser	4x4	09:15	09:30	Sixth entry
2019-01-15	09:30	Robert Black	Toyota Land Cruiser	4x4	09:30	09:45	Seventh entry
2019-01-15	09:45	Lisa Grey	Toyota Land Cruiser	4x4	09:45	10:00	Eighth entry
2019-01-15	10:00	James Blue	Toyota Land Cruiser	4x4	10:00	10:15	Ninth entry
2019-01-15	10:15	Anna Yellow	Toyota Land Cruiser	4x4	10:15	10:30	Tenth entry
2019-01-15	10:30	Chris Purple	Toyota Land Cruiser	4x4	10:30	10:45	Eleventh entry
2019-01-15	10:45	Michelle Pink	Toyota Land Cruiser	4x4	10:45	11:00	Twelfth entry
2019-01-15	11:00	Kevin Orange	Toyota Land Cruiser	4x4	11:00	11:15	Thirteenth entry
2019-01-15	11:15	Nicole Silver	Toyota Land Cruiser	4x4	11:15	11:30	Fourteenth entry
2019-01-15	11:30	Brandon Gold	Toyota Land Cruiser	4x4	11:30	11:45	Fifteenth entry
2019-01-15	11:45	Stephanie Bronze	Toyota Land Cruiser	4x4	11:45	12:00	Sixteenth entry
2019-01-15	12:00	Eric Copper	Toyota Land Cruiser	4x4	12:00	12:15	Seventeenth entry
2019-01-15	12:15	Olivia Tin	Toyota Land Cruiser	4x4	12:15	12:30	Eighteenth entry
2019-01-15	12:30	Benjamin Lead	Toyota Land Cruiser	4x4	12:30	12:45	Nineteenth entry
2019-01-15	12:45	Victoria Platinum	Toyota Land Cruiser	4x4	12:45	13:00	Twentieth entry
2019-01-15	13:00	Gregory Silver	Toyota Land Cruiser	4x4	13:00	13:15	Twenty-first entry
2019-01-15	13:15	Chloe Gold	Toyota Land Cruiser	4x4	13:15	13:30	Twenty-second entry
2019-01-15	13:30	Benjamin Bronze	Toyota Land Cruiser	4x4	13:30	13:45	Twenty-third entry
2019-01-15	13:45	Stephanie Copper	Toyota Land Cruiser	4x4	13:45	14:00	Twenty-fourth entry
2019-01-15	14:00	Eric Tin	Toyota Land Cruiser	4x4	14:00	14:15	Twenty-fifth entry
2019-01-15	14:15	Olivia Lead	Toyota Land Cruiser	4x4	14:15	14:30	Twenty-sixth entry
2019-01-15	14:30	Benjamin Platinum	Toyota Land Cruiser	4x4	14:30	14:45	Twenty-seventh entry
2019-01-15	14:45	Victoria Silver	Toyota Land Cruiser	4x4	14:45	15:00	Twenty-eighth entry
2019-01-15	15:00	Gregory Gold	Toyota Land Cruiser	4x4	15:00	15:15	Twenty-ninth entry
2019-01-15	15:15	Chloe Bronze	Toyota Land Cruiser	4x4	15:15	15:30	Thirtieth entry
2019-01-15	15:30	Benjamin Copper	Toyota Land Cruiser	4x4	15:30	15:45	Thirty-first entry
2019-01-15	15:45	Stephanie Tin	Toyota Land Cruiser	4x4	15:45	16:00	Thirty-second entry
2019-01-15	16:00	Eric Lead	Toyota Land Cruiser	4x4	16:00	16:15	Thirty-third entry
2019-01-15	16:15	Olivia Platinum	Toyota Land Cruiser	4x4	16:15	16:30	Thirty-fourth entry
2019-01-15	16:30	Benjamin Silver	Toyota Land Cruiser	4x4	16:30	16:45	Thirty-fifth entry
2019-01-15	16:45	Victoria Gold	Toyota Land Cruiser	4x4	16:45	17:00	Thirty-sixth entry
2019-01-15	17:00	Gregory Bronze	Toyota Land Cruiser	4x4	17:00	17:15	Thirty-seventh entry
2019-01-15	17:15	Chloe Copper	Toyota Land Cruiser	4x4	17:15	17:30	Thirty-eighth entry
2019-01-15	17:30	Benjamin Tin	Toyota Land Cruiser	4x4	17:30	17:45	Thirty-ninth entry
2019-01-15	17:45	Stephanie Lead	Toyota Land Cruiser	4x4	17:45	18:00	Fortieth entry
2019-01-15	18:00	Eric Silver	Toyota Land Cruiser	4x4	18:00	18:15	Forty-first entry
2019-01-15	18:15	Olivia Gold	Toyota Land Cruiser	4x4	18:15	18:30	Forty-second entry
2019-01-15	18:30	Benjamin Bronze	Toyota Land Cruiser	4x4	18:30	18:45	Forty-third entry
2019-01-15	18:45	Victoria Copper	Toyota Land Cruiser	4x4	18:45	19:00	Forty-fourth entry
2019-01-15	19:00	Gregory Tin	Toyota Land Cruiser	4x4	19:00	19:15	Forty-fifth entry
2019-01-15	19:15	Chloe Lead	Toyota Land Cruiser	4x4	19:15	19:30	Forty-sixth entry
2019-01-15	19:30	Benjamin Platinum	Toyota Land Cruiser	4x4	19:30	19:45	Forty-seventh entry
2019-01-15	19:45	Victoria Silver	Toyota Land Cruiser	4x4	19:45	20:00	Forty-eighth entry
2019-01-15	20:00	Gregory Gold	Toyota Land Cruiser	4x4	20:00	20:15	Forty-ninth entry
2019-01-15	20:15	Chloe Bronze	Toyota Land Cruiser	4x4	20:15	20:30	Fiftieth entry

Ndabaka Gate

Ndabaka Gate

Arrivals book

[illegible]

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

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.

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

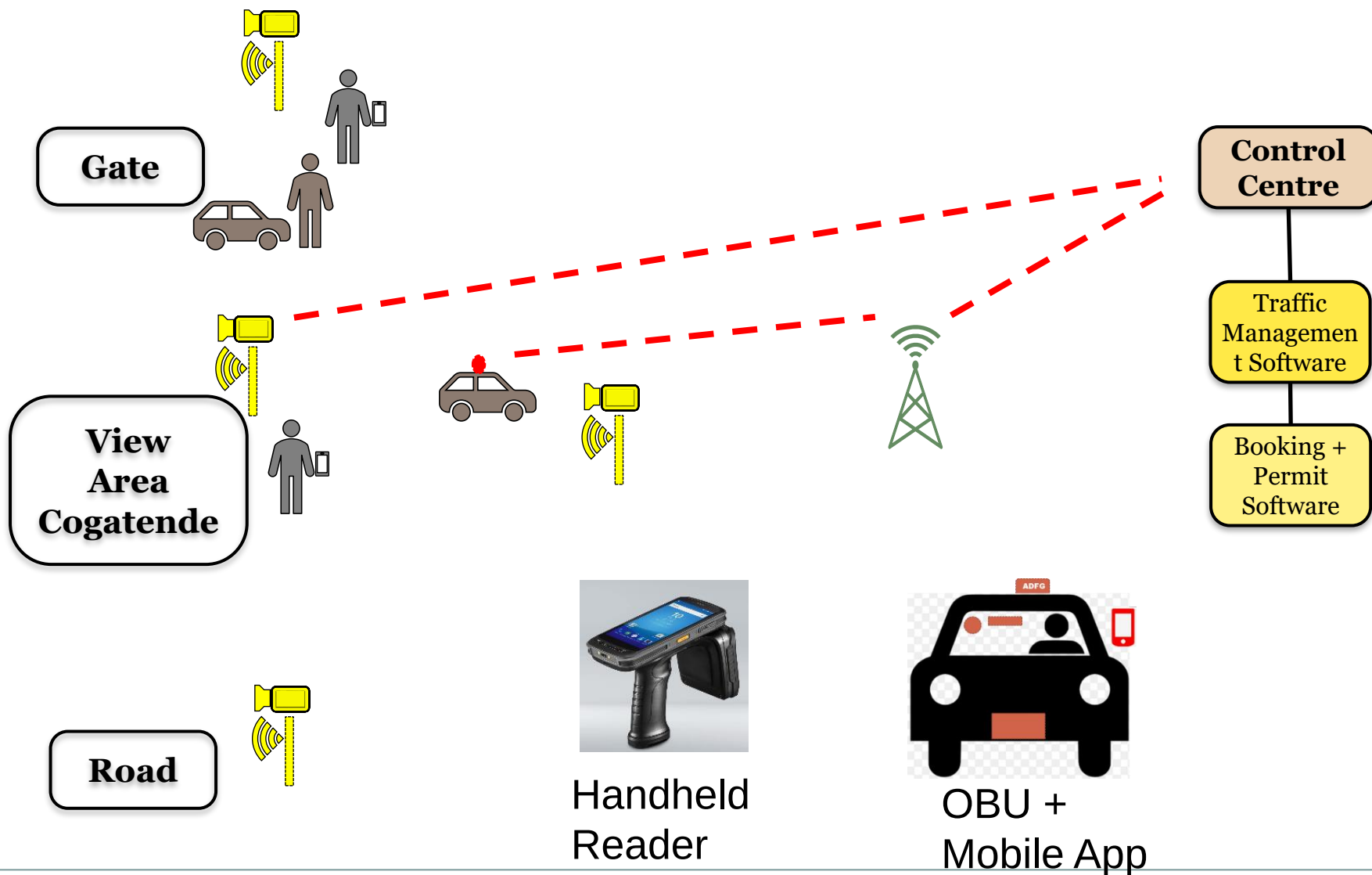
- R1 More wardens with vehicles
- R2 Education and awareness of tourists
- R3 Vehicle Reporting mechanism
- R4 Aerial surveillance using aircraft or drones
- R5 On-board units with GPS and geofencing

Alternative Solutions

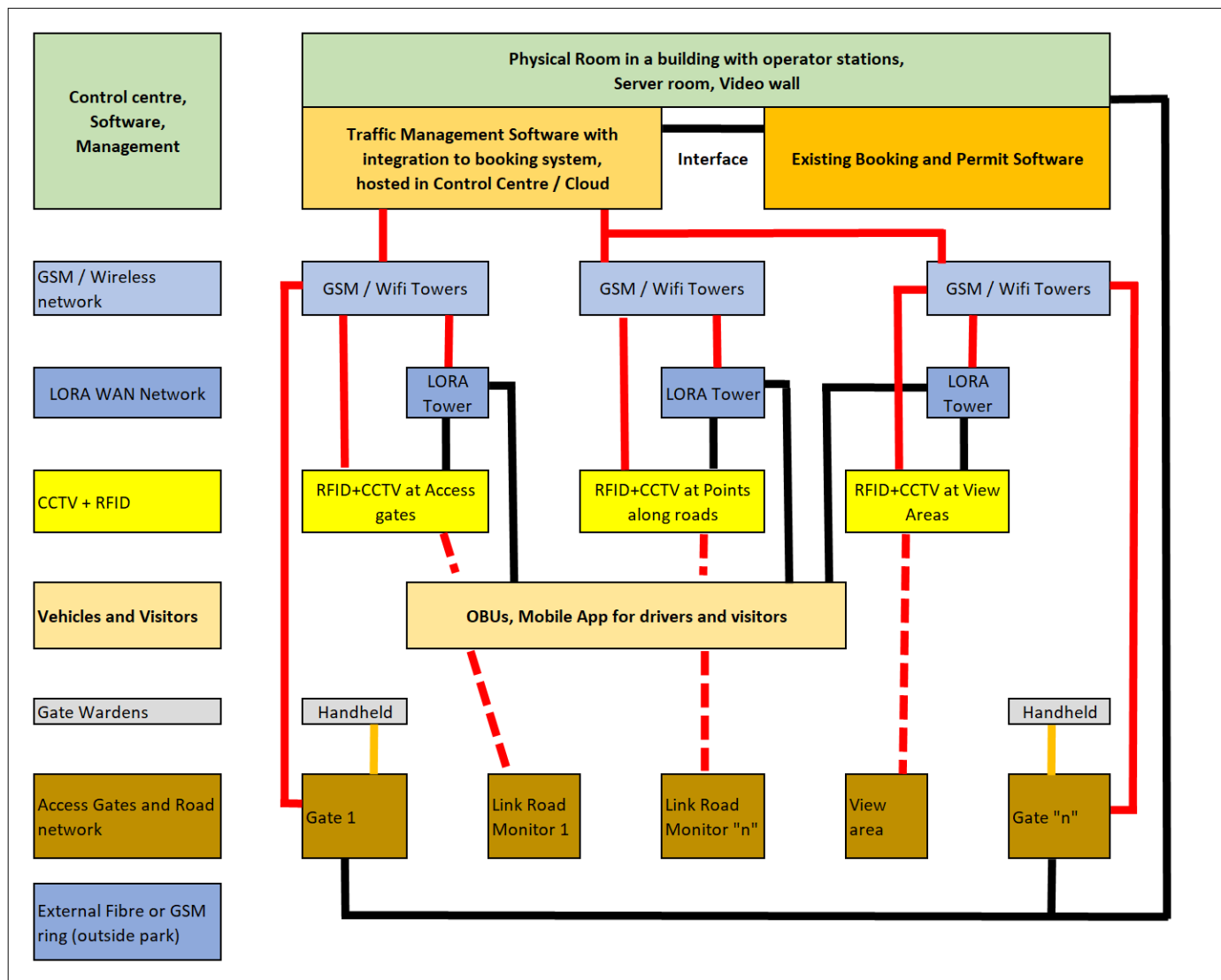
Crowding / Congestion

- 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

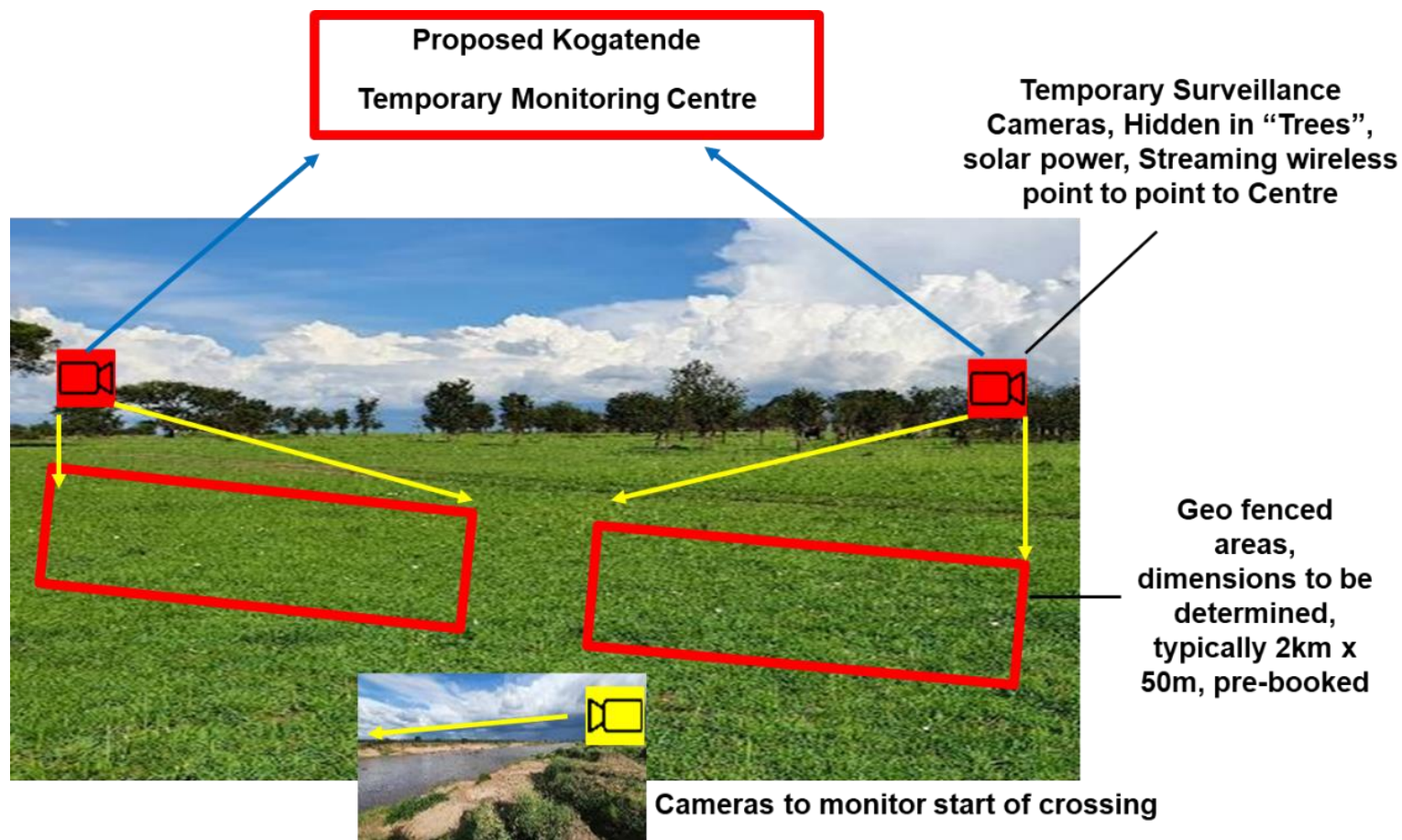
Proposed Solution



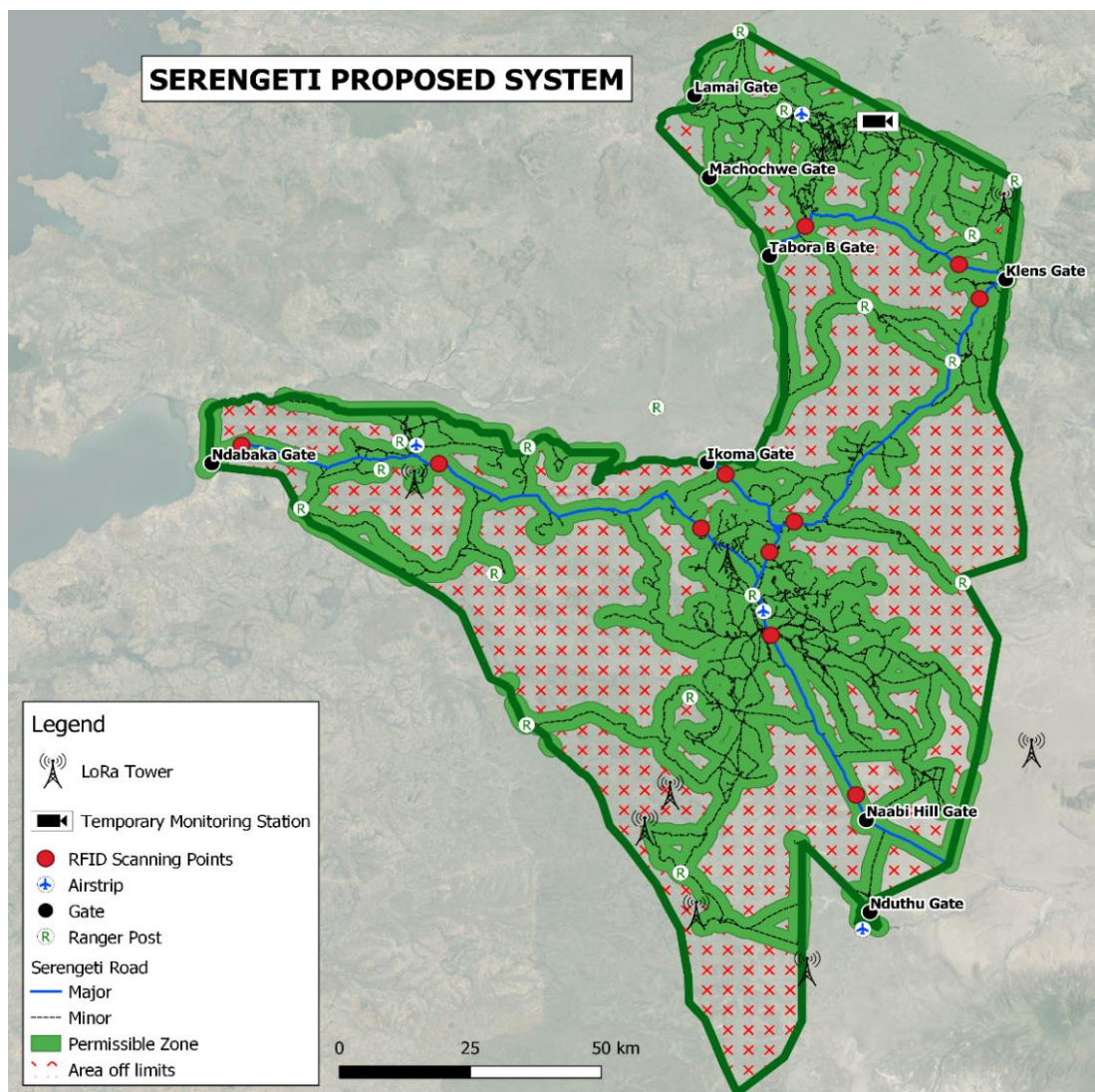
Proposed Solution – Architecture



Viewing Areas Congestion Management



Spot vehicles along the roads Compliance monitoring



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