Republic of Rwanda
Ministry of Environment

REMA
OUR ENVIRONMENT OUR FUTURE

UCI Championships Special Report

September 2025

What was the impact of the seven-day UCI Championship road closures on Kigali's air quality?

Data & Methodology

- **Where we measured:**
  - **Route Sensors** – placed along and near the UCI race route.
  - **Non-Route Sensors** – placed farther away, along the truck re-route corridors.
- **When we measured:**
  - **Baseline:** Daily data collected for 3 months before the event.
  - **Race Week:** 20–25 September 2025.
- **What we measured:**
  - **PM2.5** (fine particles in the air, measured in micrograms per cubic meter – μg/m³)
  - Recorded every hour.
- **How we analyzed:**
  - Calculated hourly averages for Route vs Non-Route sensors.
  - Compared daily (diurnal) patterns of air quality.
  - Used 95% confidence intervals from the baseline to check if race-week changes were significant.
- **Why this works:**
  - Comparing different locations, with months of baseline data, allowed us to isolate the effect of extended road closures on air quality.

Where were our sensors located relative to the race route during the UCI World Championships?

During the UCI event, RNP identified roads that were fully closed, those designated as alternative routes for passenger vehicles, and those used for truck re-routing. The map below shows where our sensors were located in relation to these roads

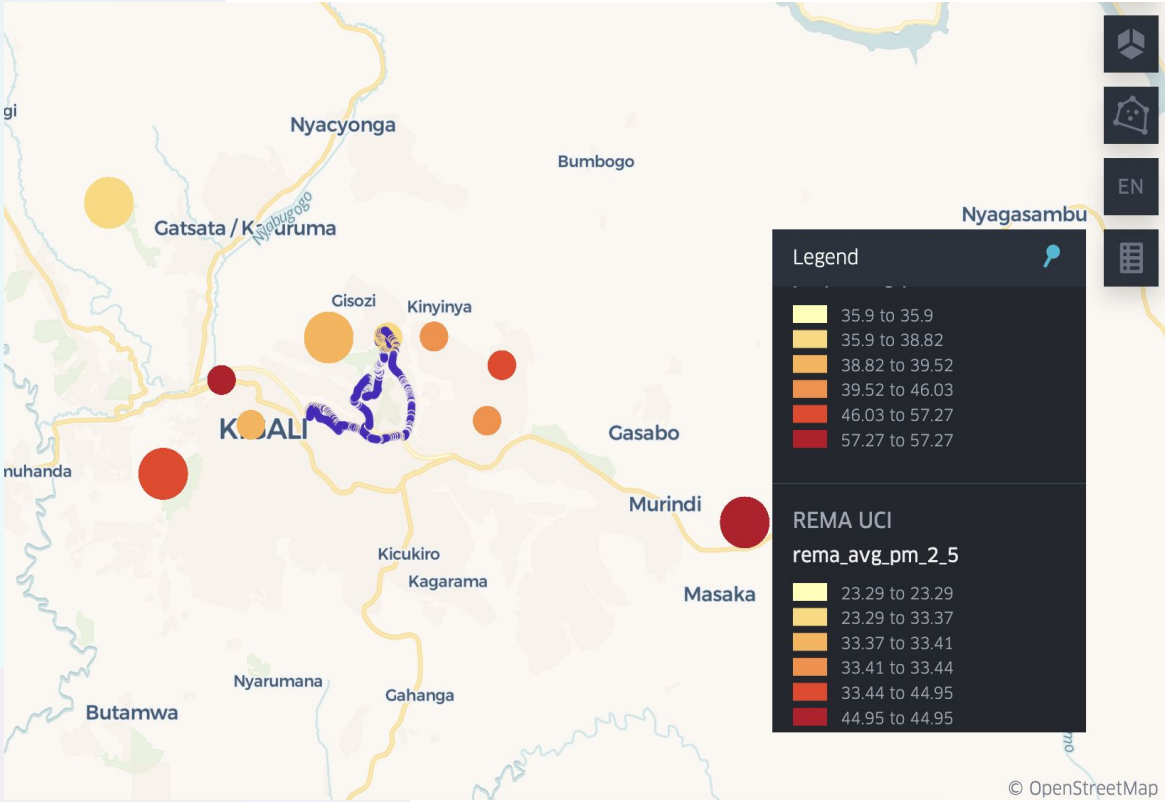
Route Sensors:

We had 6 sensors located on or near the race route:

- **1 sensor in Nyarutarama** – located on a completely closed road, referred to in this report as a **closed route sensor**.
- **5 sensors** – positioned near closed roads or on alternative routes for passenger vehicles, referred to in this report as **alternative route sensors**.

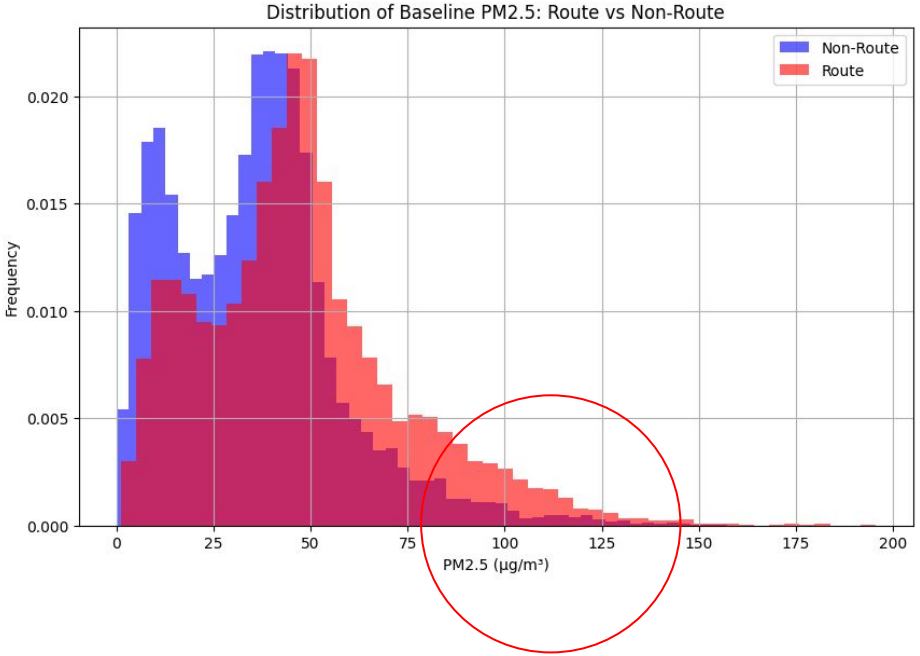
Non-Route Sensors:

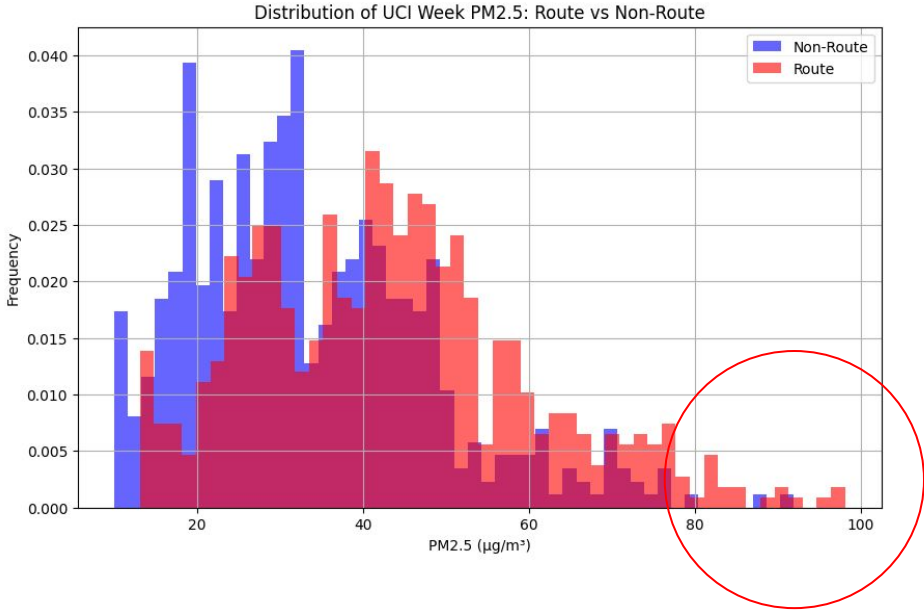
- **4 sensors (larger ones)** – located notably far away from road closures
  a. **3 of these** – positioned directly on truck re-routing routes.



UCI Road Closures Significantly Improved Air Quality Across Kigali

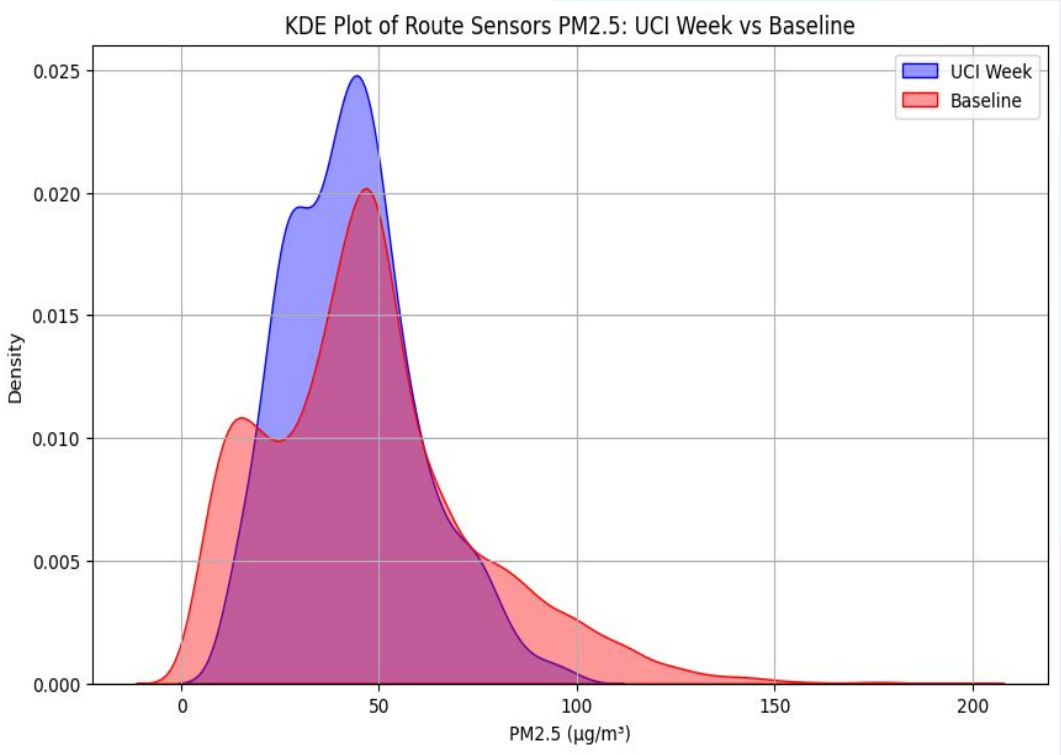
Looking at the entire dataset, air was consistently cleaner during the event, with fewer extreme pollution events. While a substantial number of readings in the baseline exceeded 100 µg/m³, nearly **none of the sensors recorded a value of 100 µg/m³ or higher during race week.** This reinforces the conclusion that traffic restrictions significantly improve air quality across the city.





PM2.5 Levels Dropped Significantly Along the Race Route During UCI Week

Looking at sensors on or near road closures, PM2.5 peaks were lower and extreme pollution events were fewer, indicating cleaner air from traffic restrictions



Leftward Shift in Distribution

- UCI Week readings (blue) are concentrated at lower PM2.5 levels.
- Baseline (red) has a wider spread with more high-concentration events

Peak Density

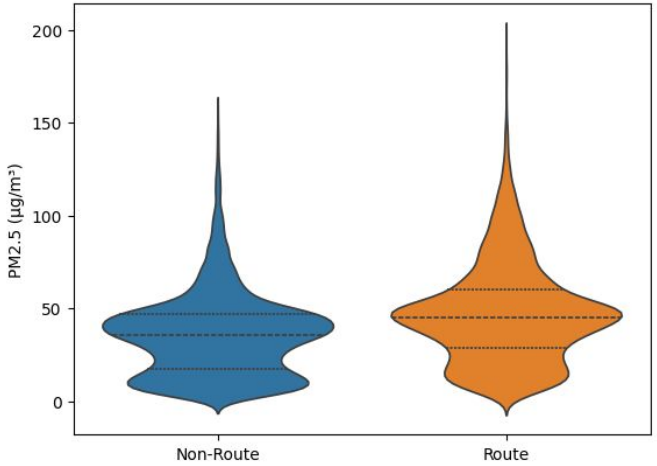
- UCI Week peak occurs at ~40 µg/m³, lower than baseline peak near 45–50 µg/m³

Fewer High-Pollution Episodes

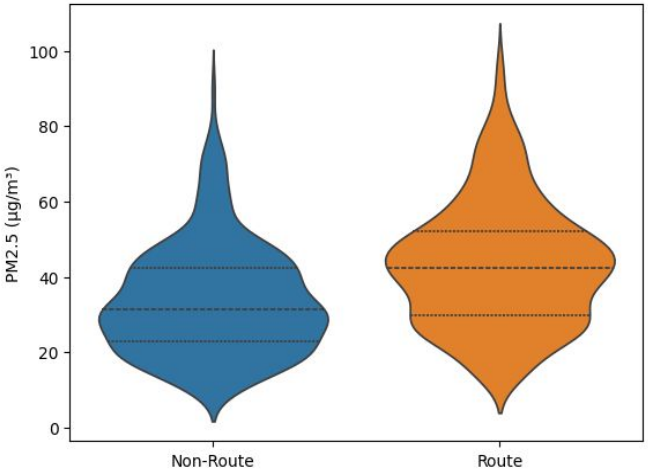
- Long tail on baseline curve shows more frequent episodes greater than 100 µg/m³

This KDE plot visualises the entire distribution of PM2.5 readings from the route sensors. The **blue curve (UCI Week)** is shifted left compared to the **red curve (Baseline)**, meaning air was consistently cleaner during the event. There are also **fewer extreme pollution events**, as seen by the much smaller tail above 100 µg/m³. This reinforces the conclusion that traffic restrictions significantly improved air quality.

Violin Plot: PM2.5 Baseline Distribution for Route and Non-Route Sensors



Violin Plot: PM2.5 UCI week Distribution for Route and Non-Route Sensors



Significant Decrease in Median and Mean PM2.5 During UCI Week

Route Sensors:

- **Median PM2.5:**
  - Baseline: 47.5 µg/m³
  - UCI Week: 38.0 µg/m³ → **20% reduction**
- **Mean PM2.5:**
  - Baseline: 50.1 µg/m³
  - UCI Week: 39.8 µg/m³ → **~21% reduction**

Non-Route Sensors:

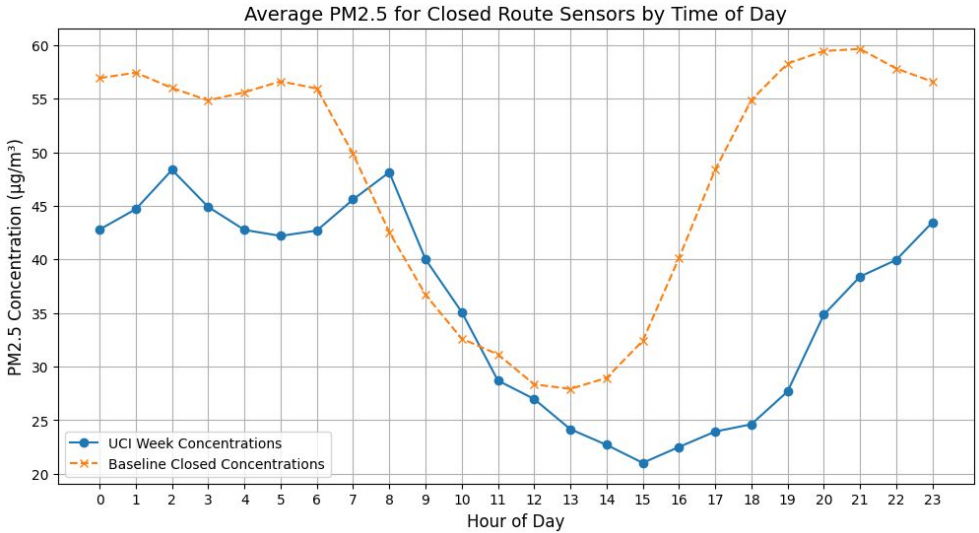
- **Median PM2.5:**
  - Baseline: ~35 µg/m³
  - UCI Week: ~34 µg/m³ → **~3% reduction**
- **Mean PM2.5:**
  - Baseline: ~36–37 µg/m³
  - UCI Week: ~35–36 µg/m³ → **~3% reduction**

Key Takeaways:

- On **Route Sensors**, both mean and median PM2.5 showed a clear and statistically significant reduction during UCI Week, consistent with KDE and diurnal profile shifts.
- On **Non-Route Sensors**, PM2.5 levels exhibited minimal change, highlighting that improvements were localized to areas affected by road closures.
- Looking at absolute numbers, non-route sensors recorded lower PM2.5 in both baseline and UCI Week, reflecting that the UCI race took place on Kigali's busiest roads, where traffic—and therefore pollution—is typically highest.

PM2.5 Levels On **Closed Routes** Dropped 40–45% During Road Closures

Looking at sensors on closed routes, PM2.5 levels dropped significantly during race week.



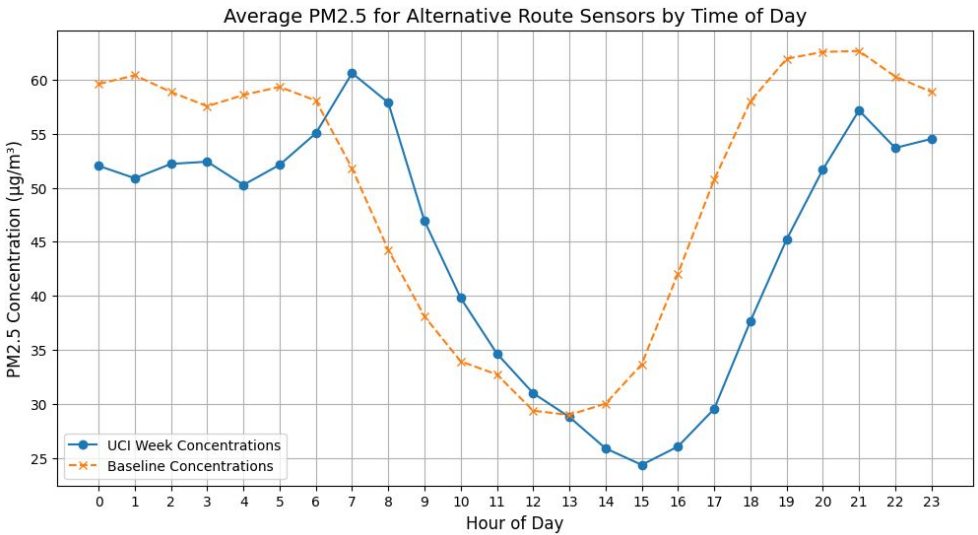
- **Major Reduction During Closure Hours:**
  - Between 10:00–15:00, PM2.5 dropped by ~40–45% compared to baseline.
- **Lowest Readings at Midday:**
  - Midday UCI Week concentrations consistently remained below 30 µg/m³.
- **Evening Rebound:**
  - Levels rose after roads reopened, approaching baseline by night but stayed below it for most of the evening.

Key Insight:

- The improvement was not just temporary; residual benefits persisted beyond official closure hours, likely due to staggered truck return and reduced congestion, compounding public health gains.

PM2.5 Levels Near **Alternative Routes** Dropped 30–40% During Road Closures

Looking at sensors on alternative routes—near but not on closed roads—PM2.5 levels dropped significantly during race week.



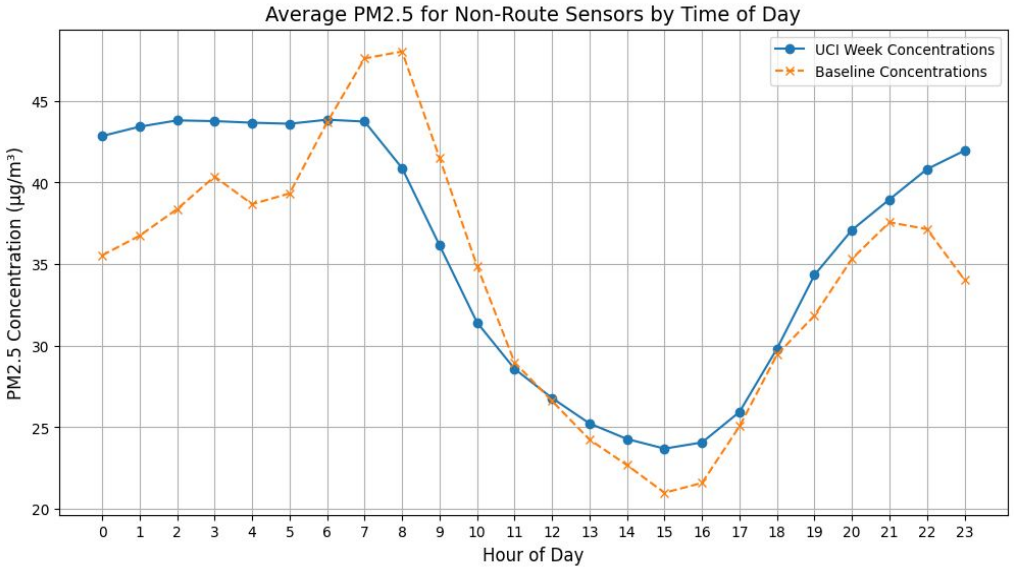
- **Significant Daytime Drop:**
  a. During UCI Week, PM2.5 levels (blue solid line) fell sharply from 08:00–15:00, remaining well below baseline (orange dotted line) from 12 noon onwards. .
  b. The steepest reductions occurred between 13:00–15:00, with midday values up to 40% lower than normal.
- **Morning Peak:**
  a. The early morning spike likely reflects pre-race traffic and residual movement before closures took effect.
- **Evening Return:**
  a. PM2.5 levels rose after 18:00 as roads reopened and truck traffic resumed, but remained below baseline, showing sustained improvement.

Key Insights:

- Road closures and traffic rerouting had a measurable, statistically significant effect on improving air quality along alternative routes.
- Even though these roads were open to passenger traffic, travel decreased substantially, likely due to government stay-at-home requests and closures of schools and workplaces.
- The reductions indicate that restricted traffic—not just road closures on the race route—contributed to cleaner air across the alternative routes.

Non-Route PM2.5 Levels Stayed Largely Unchanged During UCI Week

Looking exclusively at data from the non-route sensors—those located well away from the road closures—shows that PM2.5 levels did not change significantly during race week



Daytime Patterns Remain Similar:

- A midday dip is visible in both Baseline and UCI Week data.

No Significant Improvement Away from Race Route:

- Unlike the race route, non-route sensors show no sharp drop in PM2.5 during road closure hours (09:00–15:00).

Evening Trends Unchanged:

- Both Baseline and UCI Week lines rise again in the evening, reflecting the typical citywide daily cycle.

Key Insight:

- The blue line (UCI Week) closely follows the orange Baseline line, with only minor variations.
- The absence of dramatic reductions outside the race route confirms that PM2.5 improvements were specific to the road closures and not driven by weather or other citywide factors.

Key Findings

The UCI races in Kigali led to the closure of major roads across the city, and schools and workplaces were encouraged to allow work-from-home arrangements. This analysis aimed to measure how this interruption to daily traffic affected air quality.

Closed Routes:

- PM2.5 reductions were largest on the closed roads, dropping by ~40–45%, with cleaner air persisting even after 6 PM when roads reopened. This demonstrates a strong and sustained impact of the road closures.

Alternative Routes:

- Air quality improvements were also observed on nearby alternative routes, with reductions of ~30–35%. This likely reflects both the residual effect of proximity to closed roads and reduced traffic due to school and workplace closures.

Non-Route Sensors:

- Routes far from closures, including truck re-routing corridors, showed little to no change in PM2.5, indicating that the effects were localized to areas affected by traffic restrictions.