



# Assessment of Air Quality in Indoor Environment using Portable Sensors

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**Abstract:** 91% of the world's population lives in areas where air quality exceeds WHO standards. In particular, household air pollution causes 3.8 million deaths globally. Except for household pollution, indoor pollution also includes exposure to air pollution in transport systems, offices, factories, malls, and other buildings. Subway systems are used extensively in Japan, and there is more pollutant air compared to ambient air. Therefore, it is important to monitor the air quality, especially PM<sub>2.5</sub> PM<sub>10</sub> to keep the air quality within the allowable level. In this study, the air quality at several locations in the Tokyo Subway System was examined by using portable sensors. As a result, it was observed that there was a significant variation at different positions within the same underground platform, and the above-ground stations had a better quality than the underground stations.

## 1. Introduction

### Research questions:

⇒ How does air quality vary in subway (both above and underground) train system in Tokyo?

### Objective:

- ⇒ Examine the air quality in Subway system in the Tokyo subway system.
- ⇒ Examine the air quality (PM<sub>2.5</sub> and PM<sub>10</sub>) within the platforms at several points.
- ⇒ Discuss the co-relation of various factors with PM values.

## 2. Methodology

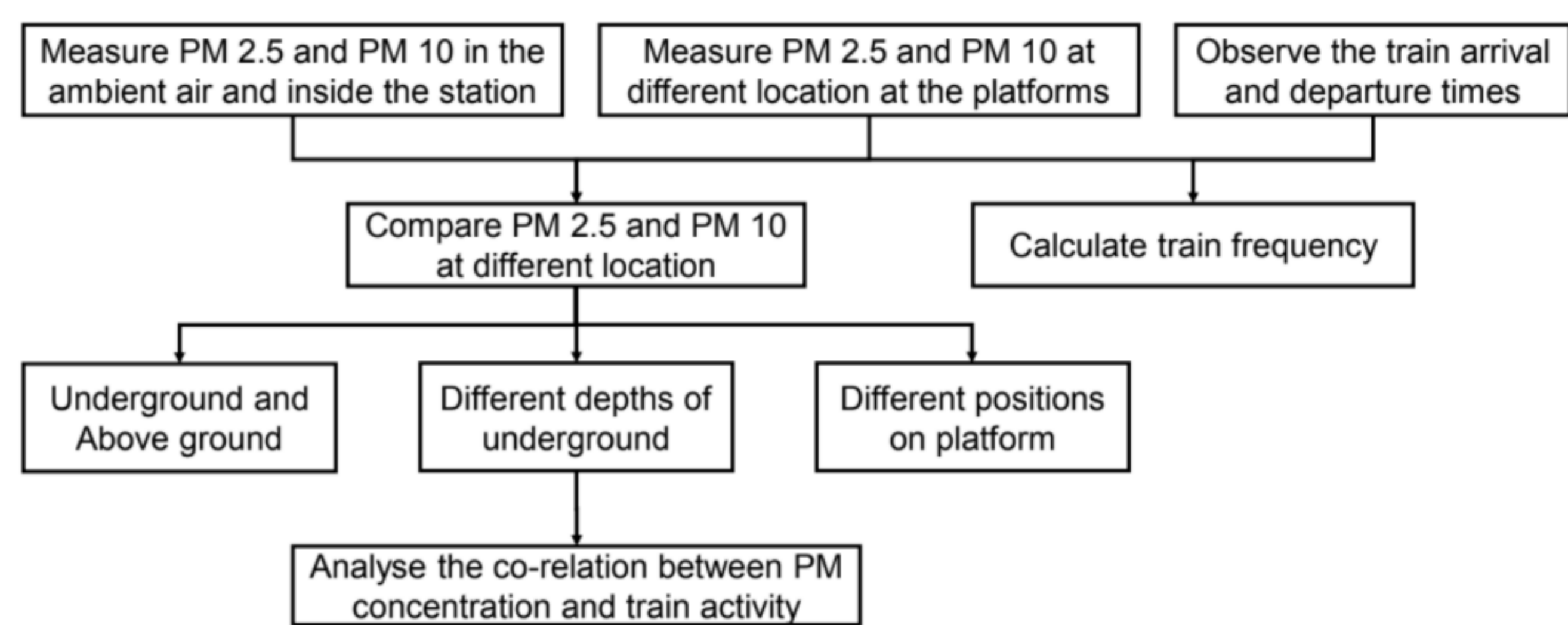


Fig 2.1 : Flow Chart of this Study

## 3. Results

### Variation of PM with Train Arrival and Departure

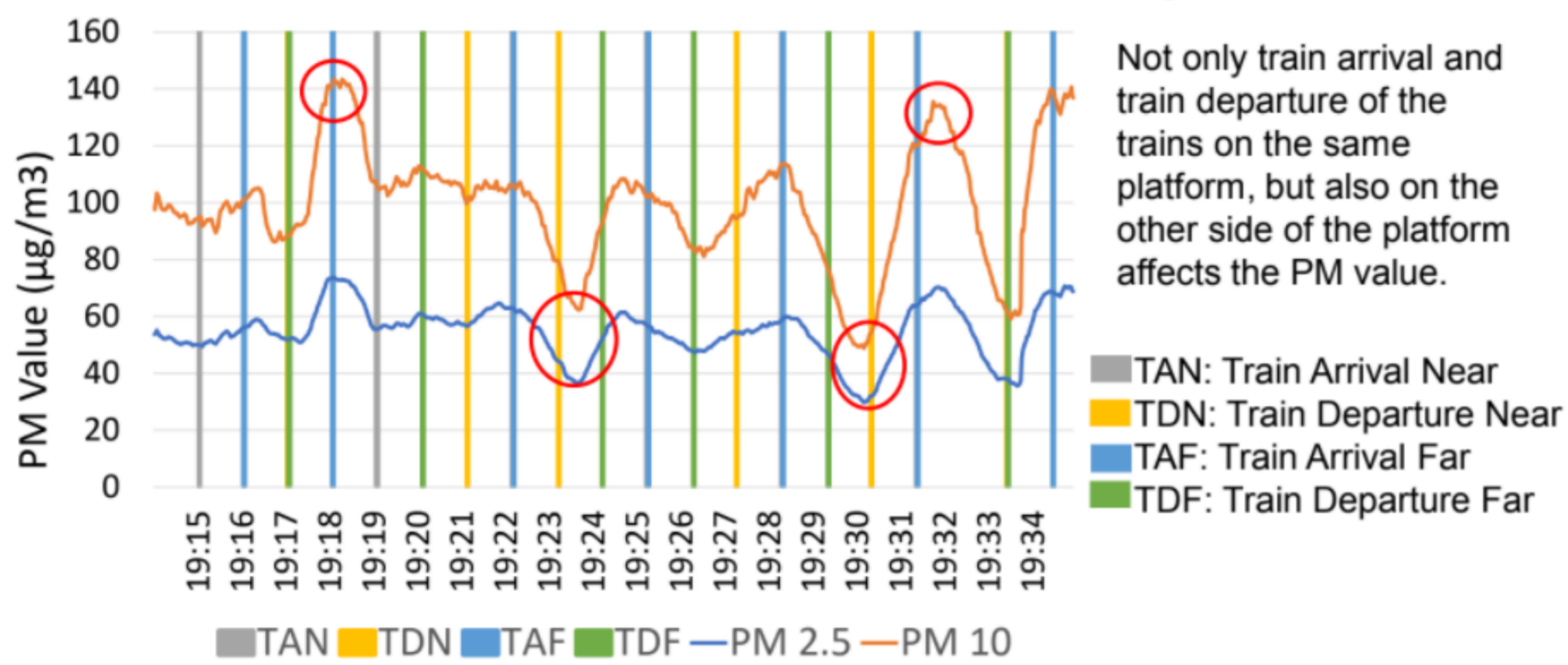


Fig 3.1 : Concentration profile of PM 2.5 and PM<sub>10</sub> on Line 3 at Position 1 on a weekday

### Average PM Values for underground lines is not safe

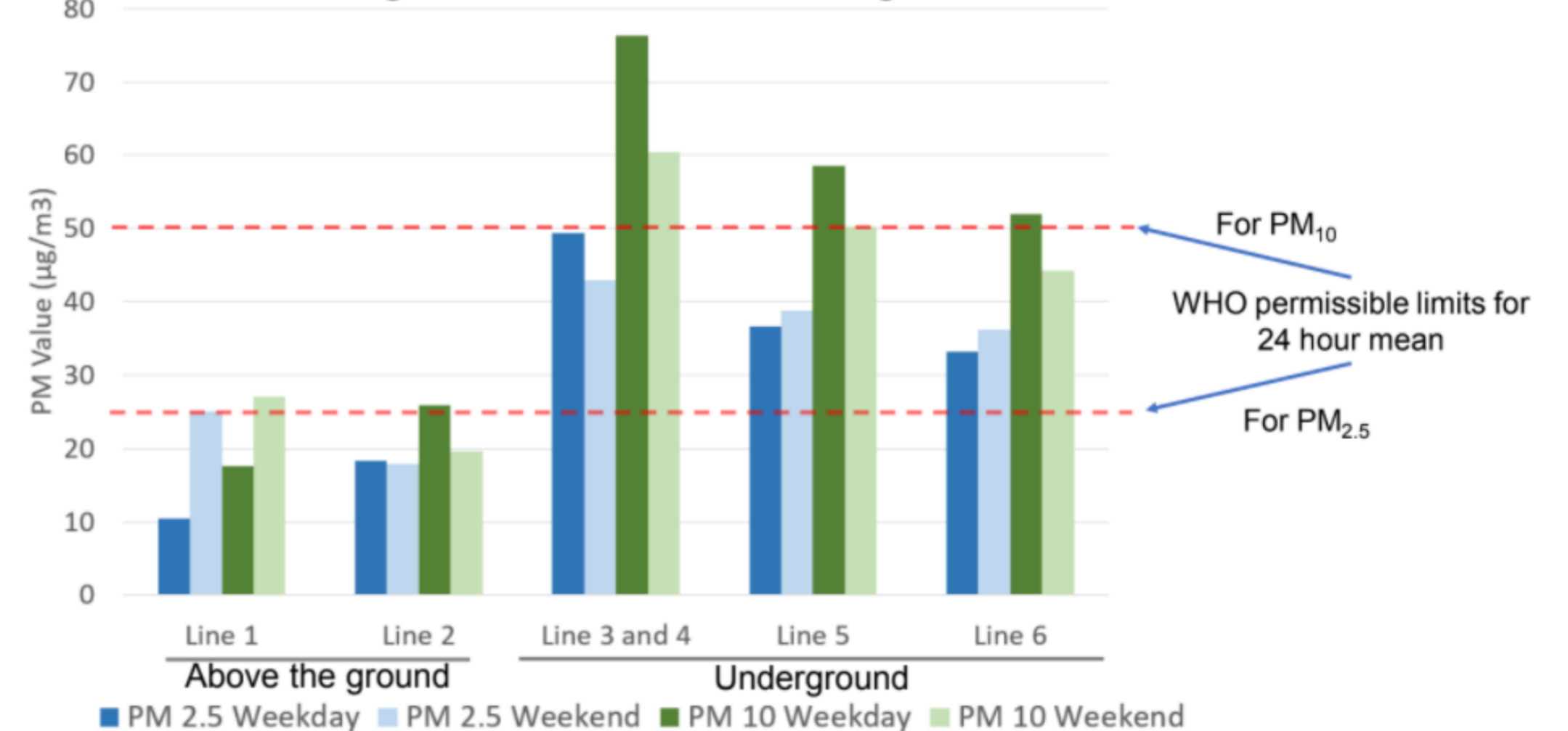


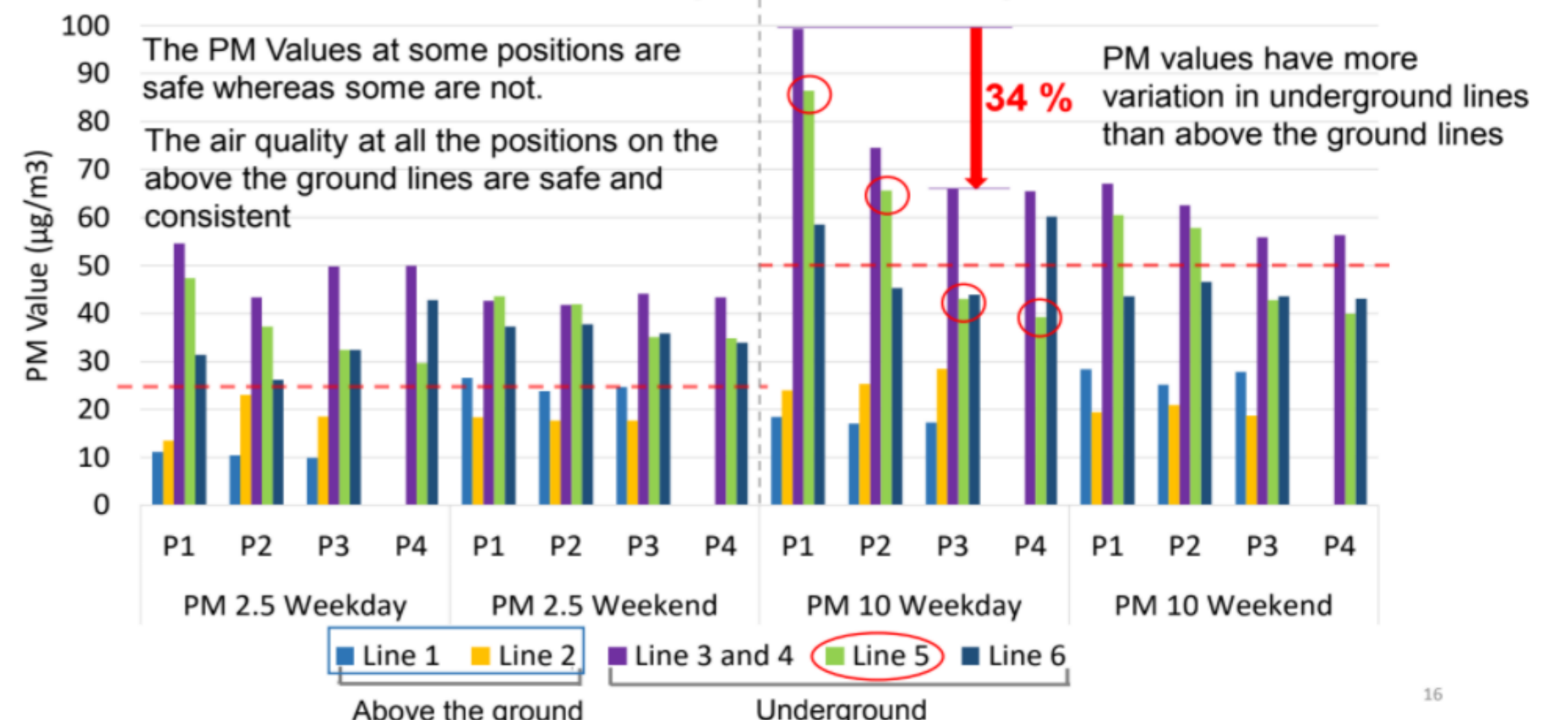
Fig 3.5 : Average PM Values variation in various lines on a weekday and weekend

Table 3.1 : Variation of PM Values in various lines and its variation with frequency and location

Line No.	Line Location	Frequency of trains in the Tunnel (minute)		Average PM Values (µg/m <sup>3</sup> )	
		Weekday	Weekend	PM 2.5	PM 10
1	Above Ground	4	4	17.74	22.35
2	Above Ground	1.7	1.5	18.10	22.77
3 and 4	Underground (B3)	1.6	2.3	46.20	68.41
5	Underground (B5)	1.9	1.9	37.75	54.43
6	Underground (B5)	1.9	1.9	34.67	48.11

- Train Frequency does not affect average PM Values in the subway system
- Air Quality of Above the ground lines is better than Underground lines

### Variation of PM Values at various positions within a platform for different lines



## 4. Conclusion

- Air quality in above-ground train lines is better than the underground train lines due to the frequent exchange of air with the movement.
- Air quality at train heads had higher PM concentrations because of the train-piston effect. It resulted in variable air quality within the train line.