LSM TECHNOLOGIES

# Technical Bulletin No 19

## *Discussion Paper– Safety Outcomes from OTSI Annual Reporting (2015–2024)*- following the Transport for NSW mandate for implementation of TMSystems (BC17/18562) wheel end / tyre fire mitigation contorl across the TfNSW Bus fleet.

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Dated: 12th January 2026

# TB#19: Safety Outcomes OTSI 2015- 2024- TfNSW Mandate TMS (BC17/18562)

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## 1. EXECUTIVE SUMMARY.

The purpose of this discussion paper / report is to analyse: **Tyre Monitoring Systems (TMS) on TfNSW Buses Origin, Mandate, and Demonstrated Safety Outcomes (2015–2024).**

This report has been prepared to provide Transport for NSW (TfNSW) and the Office of Transport Safety Investigations (OTSI) with a complete, up-to-date reconstruction of:

- The historic safety problem that led to the introduction of Tyre Monitoring Systems (TMSystems) on NSW buses.
- The policy and mandate pathway, including the Bus Industry Confederation (BIC) Fire Advisory and TfNSW Specification BC17/18562.
- The demonstrated safety outcomes, using OTSI- reported data, showing that wheel / brake / tyre fire events have been eliminated since TMS rollout, while thermal detections continue without progressing to fire.
- This document is explicitly intended to restore institutional memory within TfNSW and OTSI following staff turnover and organisational change.

In addition this discussion paper should be read in conjunction with our ***TB- 0018- TMSystems- Bus Fire- Thermal Events Mandate v1.0 09012026*** that discusses the TfNSW Bus Draft Vehicle Fire Safety- Part 1 and the recommended inclusion of TMSystems

## 2. PRE-INTERVENTION RISK PROFILE (PRE-2017).

### 2.1 OTSI findings (2013–2016).

- OTSI annual Bus Fire Safety Reports from 2013 to 2016 consistently identified **Wheel wells and braking systems** as a major origin of bus fires.
- Frequent causation linked to:
    - Brake calliper seizure.
    - Dragging or incorrectly adjusted brakes.
    - Air system and park-brake faults.
    - Under inflated tyres.
- Fires often progressing rapidly from overheating to flame ignition before drivers were aware of the risk.
- By 2015–2016, wheel / brake / tyre fires accounted for **up to approximately 40- 45% of bus fire incidents** in NSW in some years.
- This risk profile was well documented and accepted by regulators, operators and industry bodies.

## 3. INDUSTRY RESPONSE- (BIC) BUS INDUSTRY CONFEDERATION FIRE ADVISORY (2014).

In response to the recurring patterns identified by OTSI, the **Bus Industry Confederation (BIC)** commissioned the Fire Mitigation Advisory (2014) report released in **September 2014**.

### 3.1 Key findings included:

- Wheel- end overheating was a predictable precursor to fire ignition.
- Driver awareness was often delayed until smoke or flame was visible.
- Continuous monitoring of tyre pressure and temperature was recommended as a primary fire-prevention control, not merely a maintenance tool.
- This report formed a key evidentiary basis for subsequent TfNSW policy decisions.
- International regulative / industry bodies had determined that TMSystems was a solution to wheel- end / brake / tyre related fires.

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## 4. TFNSW POLICY AND MANDATED CONTROLS.

### 4.1 Tyre Monitoring Systems- TfNSW Specification BC17/18562 (2017).

In 2017, NfNSW TMSystems specification- **BC17/18562** on Buses, mandating the fitment of **Tyre Monitoring Systems (TMSystems)** on TfNSW-contracted buses.

#### 4.1.1 Explicit objective of the Mandate:

- To mitigate bus fires caused by brakes, wheel ends and tyres through early detection of abnormal temperature and pressure conditions, enabling intervention prior to ignition.

#### 4.1.2 Key characteristics:

- Continuous tyre pressure and temperature monitoring.
- Real-time driver alerts.
- Integration into TfNSW bus contract requirements.

#### 4.1.3 Implementation;

- LSM Technologies commenced proving and deployment in 2017 and estimates that **more than 4,000 buses** in NSW are now fitted with LSM TyreGuard® **TMSystems.**

### 4.2 Engine Bay Fire Suppression Systems (EBFS).

In parallel, TfNSW mandated **Engine Bay Fire Suppression Systems (EBFS)** across the contracted fleet to mitigate engine- originated fires.

#### 4.2.1 Important distinction:

- **TMSystems:** prevention of wheel / brake / tyre fire ignition.
- **EBFS:** mitigation of engine- bay fires and reduction of severity.

These controls address **different fire pathways** and should not be conflated in analysis.

## 5. VERIFIED LONGITUDINAL OUTCOMES (OTSI- DERIVED DATA).

The following ***Table 1****- Wheel / Brake / Tyre Events – Thermals Vs Fires (2015–2023 / 2024)* provides for analysis of the OTSI Bus Fire Safety Report Reports from **2015** to **2023 / 2024**, noting reported data indicates that:

- "Fires" = confirmed flame events.
- "Thermals" = heat / smoke without flame / fire ignition.
- From roll- out implementation of TMSystems in 2017 onward, OTSI reporting consistently records wheel- end events as **thermal only.**
- Engine Fires still seem to be significant.

| Year | Wheel / Brake / Tyre Fires | Engine-Bay Fires | Wheel / Brake / Tyre Thermals |
|---|---|---|---|
| 2015 | 17 | 16 | – |
| 2016 | 8 | 18 | ~40 |
| **2017** | **~5** | **~10** | **~45** |
| 2018 | 1 | ~11 | ~58 |
| 2019 | 0 | ~15 | ~59 |
| 2020 | 0 | ~12 | ~43 |
| 2021 | 0 | ~10 | ~90 |
| 2022 | 0 | ~9 | ~95 |
| 2023 | 0 | ~12 | ~102 |

*Table 2-* ***Wheel / Brake / Tyre Events – Thermals Vs Fires (2015–2023 / 2024)***

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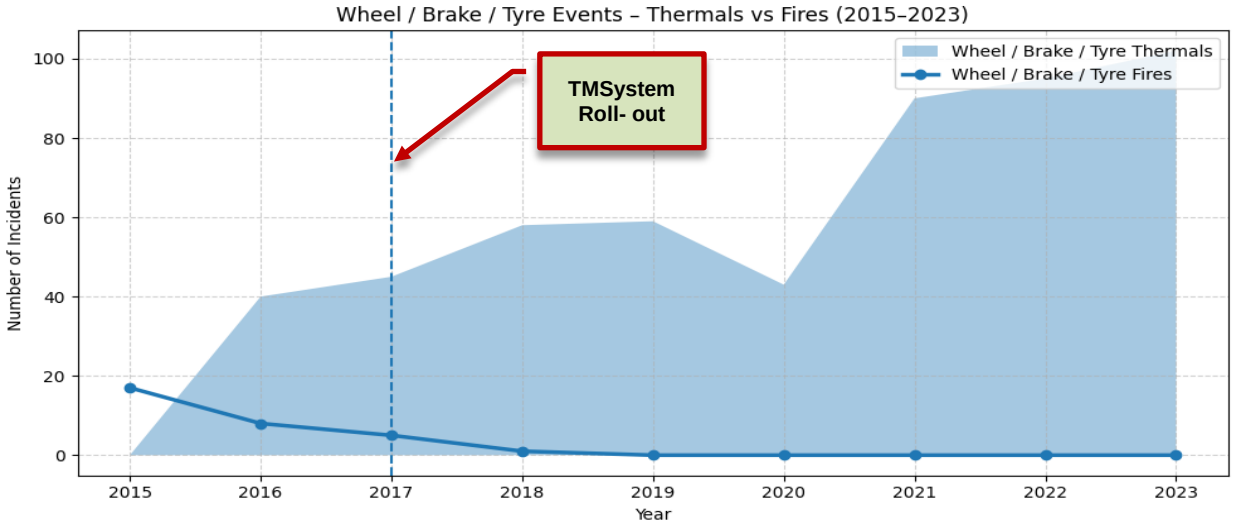


***Figure 1: Wheel / Brake / Tyre Events – Thermals Vs Fires (2015–2023)***

## 5.1 Table 3- Wheel / Brake / Tyre Events – Thermals Vs Fires (2015–2023 / 2024).

### 5.1.1 What the Figure/ Chart Shows:

- Vertical marker at 2017 (TfNSW TMS mandate).
- Shaded area: wheel / brake / tyre thermal events
- Line: wheel / brake / tyre fires.
- Thermal detections increase significantly post-2017.
- Fire events reduce to zero.
- “Fires” represent confirmed flame events.
- “Thermals” represent heat / smoke events without flame ignition.
- From **2019 onward**, OTSI reporting consistently records wheel-end events as **thermal only**, with **no confirmed wheel / brake / tyre fires**.

### 5.1.2 Key Observations:

- Wheel / brake / tyre fires collapse from double-digit values pre-2017 to zero from 2019 onward.
- Engine-bay fires persist, confirming that fire risk was not displaced, but selectively mitigated.
- Thermal detections **represent** early intervention success, **not residual fire risk**.

## 5.2 Figure 2: Bus Fire and Thermal Incident trends- TMS vs EFBS

This chart has been included in this report to further depict TMSystem trends over the past eight (8 years- now nearly a decade) as well as that for EBFS.

### 5.2.1 What the Figure/ Chart Shows:

- Engine-bay fires (orange line) continue but decline steadily with EBFS rollout.
- Wheel / brake / tyre fires (red line) drop to zero after 2018, showing the effect of LSM’s TMS rollout.
- Wheel / brake / tyre thermals (grey area) continue to rise- confirming that overheating events are still being detected early but no longer progressing to flame. Vertical marker at 2017 (TfNSW TMS mandate).

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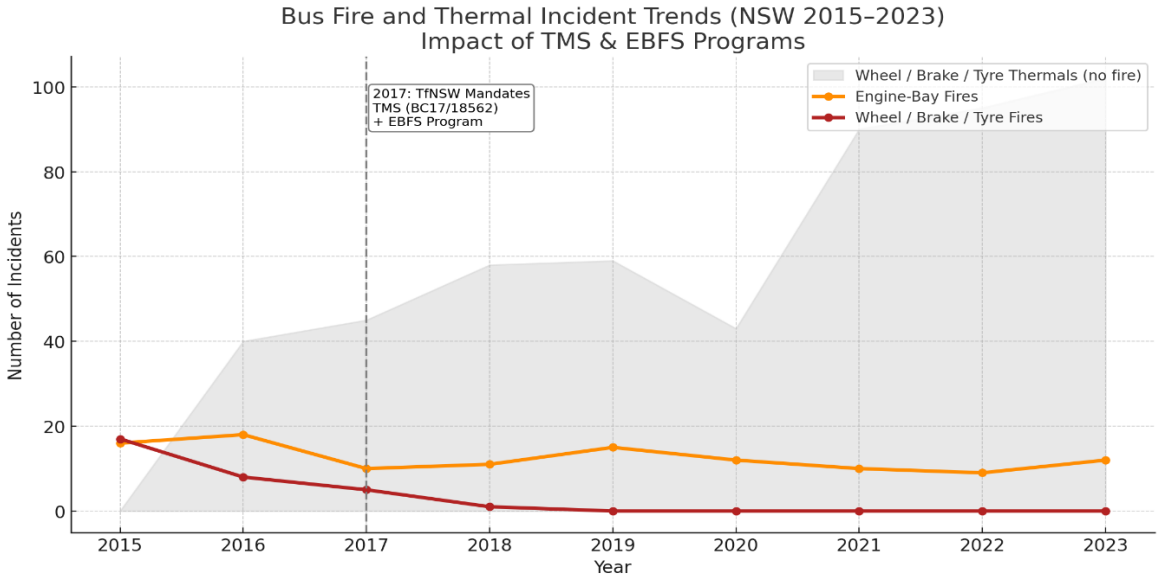


***Figure 3: Bus Fire and Thermal Incident trends- TMS vs EFBS***

## 6. INTERPRETATION AND CAUSAL LINKAGE.

The post- 2017 data pattern demonstrates a **causal relationship**, not coincidence:

- The same mechanical and operational conditions that previously led to wheel- end fires continue to occur.
- These conditions are now detected early as thermal events.
- Fire ignition is prevented.
- The safety objective of TfNSW Specification BC17/18562 has therefore **been achieved**.

## 7. MISINTERPRETATION RISK (CRITICAL FOR NEW OTSI STAFF).

Without historic context, increasing thermal counts may be misinterpreted as a deterioration in safety.

- This would be incorrect.
- Prior to TMSystem deployment many of today's thermal events would have progressed to fires.
- Post TMSystems, they are detected and managed before ignition.
- Thermal trends must always be interpreted **in conjunction with fire outcomes**, not in isolation.

### 7.1 Data Capture / Reporting Gap (TMSystems events)- Risk of Regression

A further concern relevant to interpreting OTSI- reported outcomes is that **TMSystems activations and driver responses are not being consistently captured in mandated incident reporting**.

The current OTSI Bus Fire / Thermal Incident Information Collection Form captures classification (fire vs thermal), cause category, and includes a specific question on whether the **engine bay fire suppression system** worked effectively (if activated), but it does **not** include structured fields to record **TMSystems fitment**, **alarm type**, **alarm acknowledgement / silencing**, **wheel position**, or whether **TMSystems event data was preserved/downloaded for analysis**.

This creates a visibility gap in longitudinal reporting: TMSystems is an upstream prevention control, and without structured capture of TMSystems warnings and responses, it becomes difficult to objectively trend compliance and ensure the prevention layer remains effective as organisational memory fades.

The OTSI Bus Fire Investigation – Thornton, NSW (16 October 2017) remains a clear case study demonstrating that where TMSystems alarms are not responded to with urgency (or where drivers are not trained), a wheel- end event can progress from a warning condition to a serious fire outcome, despite the TMSystems itself performing as designed.

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Accordingly, to preserve the safety outcomes documented in this paper, it is recommended that incident reporting for wheel-end/ brake/ tyre events (fire or thermal) include structured TMSystems fields such as:

- TMSystems fitted (Y/ N), make / model.
- Alarm occurred (Y/ N), alarm type (temperature / pressure / fast leak / lost signal).
- Wheel position(s) and time of first alarm.
- Driver response (stopped / continued / silenced alarm).
- Whether TMSystems event data was downloaded/preserved.
- Driver TMSystems training currency (initial + recurrent).

### 8. CONCLUSIONS.

- Wheel / brake / tyre fires were a documented and significant risk prior to 2017.
- TfNSW's mandated introduction of TMS directly targeted this ignition pathway.
- Since 2018, wheel / brake / tyre bus fires have been eliminated in NSW.
- Thermal events continue and increase, demonstrating early detection and intervention.
- Eight years of OTSI- reported data confirm TMS as a proven, effective and essential safety mitigation control.

### 9. CLOSING STATEMENT.

The post- 2017 increase in wheel- end thermal reporting, combined with the elimination of wheel/ brake / tyre bus fires, demonstrates the effectiveness of TfNSW's Tyre Monitoring System mandate.

Thermal detections represent early intervention and interruption of the ignition pathway, not increased fire risk.

TMSystems was introduced into TfNSW bus fleets deliberately, following real fire events, independent industry analysis, and government- level safety decisions.

Its effectiveness has reduced the visibility of wheel- end and tyre- origin fires.

Buse standards should preserve this preventative intent by explicitly recognising TMSystems, ensuring continuity of safety outcomes and alignment with existing TfNSW, other Industries and national practice.

- LSM TyreGuard® **TMSystems.**
- Links and References.