JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Passive Aeroelastic Exploitation of Front Floor Fillet Flexibility Under the 2026 Formula One Technical Regulations

Vivaan Narayan Keluskar
Student
Global Indian International School Tokyo Higashikasai Campus

Introduction

Since the reintroduction of ground-effect aerodynamics in Formula One in 2022, the underfloor has once again become the dominant contributor to overall vehicle downforce (Katz; F1Technical.net). Unlike wing-based aerodynamics, ground-effect systems are acutely sensitive to ride height, geometric continuity, and pressure sealing, such that millimetre-scale variations can produce disproportionately large aerodynamic consequences (Katz). As a result, modern Formula One performance is increasingly dictated not by absolute aerodynamic surface area, but by the ability to maintain an optimal aerodynamic platform across a wide range of speeds, attitudes, and load conditions.

The Fédération Internationale de l'Automobile (FIA), in response to porpoising phenomena and escalating aerodynamic sensitivity, has progressively constrained ride-height control mechanisms, suspension-aerodynamic coupling, and structural compliance. Active systems have long been prohibited (Fédération Internationale de l'Automobile; Motorsport.com), and even passive systems whose primary effect is mechanical stability—such as mass dampers and interconnected suspension networks—have been eliminated under the doctrine of "movable aerodynamic devices." Despite this tightening regulatory environment, Formula One history repeatedly demonstrates that performance gains often emerge not from overtly new devices (Racecar Engineering; Autosport; Motorsport.com), but from subtle reinterpretations of structural allowances embedded within the rulebook.

The 2026 Formula One Technical Regulations represent a further evolution of this philosophy. While imposing tighter control over wings, diffuser volumes, and underbody geometry, the regulations explicitly permit flexibility in specific structural regions, including the fillet joining the front floor bib to the main floor. This allowance is framed as a safety and durability measure, intended to permit compliance when the front of the car contacts the ground.

However, as with many such allowances in Formula One history, the aerodynamic implications of this flexibility extend beyond its stated intent.

This paper explores whether the permitted flexibility of the front floor fillet can be leveraged as a passive aeroelastic mechanism to improve aerodynamic performance. Unlike prohibited systems that rely on kinematic coupling to suspension movement or active control, the concept examined here relies solely on pressure-driven elastic deformation under aerodynamic load. In effect, the fillet is treated not as a rigid geometric boundary, but as a compliant interface whose shape adapts continuously and passively to the local pressure field.

The investigation proceeds in three stages. First, the underlying physics of ground-effect aerodynamics are reviewed, with particular emphasis on boundary-layer behaviour, Venturi acceleration, and the sensitivity of pressure distributions to small geometric perturbations. Second, historical precedents from Formula One and other high-level motorsport categories are examined, including both legal and banned innovations, to establish how passive flexibility has previously been exploited and where regulatory boundaries have been drawn. Third, the front floor fillet is analysed as an engineering structure, using simplified beam and plate theory to estimate realistic deformation magnitudes and their aerodynamic consequences.

The scope of this paper is intentionally analytical rather than computational. No computational fluid dynamics or wind-tunnel data are employed. Instead, the aim is to demonstrate, through first-principles reasoning and regulatory interpretation, that a non-negligible aerodynamic opportunity exists within the current ruleset. By framing the front floor fillet as a passive, load-responsive aerodynamic modifier rather than a movable device, this study seeks to define a clear and legally defensible pathway for performance development under the 2026 regulations.

Abstract

The 2026 Formula One Technical Regulations (Fédération Internationale de l’Automobile) introduce a revised aerodynamic framework intended to reduce wake sensitivity while maintaining underfloor-dominated downforce generation. Within this framework, a notable and explicit allowance is made for flexibility in the fillet joining the front floor bib to the main floor, primarily justified on grounds of ground-contact compliance. This paper investigates the hypothesis that this permitted flexibility may be exploited as a passive aeroelastic mechanism to achieve performance gains while remaining fully regulation compliant.

The first half of the study establishes the physical foundations governing ground-effect aerodynamics, boundary-layer behaviour near the ground plane, and the extreme sensitivity of underfloor pressure fields to millimetric geometric variation. Historical precedents of both legal and prohibited aeroelastic or compliance-based innovations in Formula One and related series are then examined to contextualize the regulatory philosophy surrounding passive deformation (Racecar Engineering; Autosport; Motorsport.com). Finally, a technical engineering analysis is presented, modelling the front floor fillet as a compliant structural element subjected to aerodynamic loading. Using simplified beam and plate theory, it is shown that realistic composite structures can exhibit millimetre-scale elastic deformation under racing loads, sufficient to meaningfully alter local Venturi throat conditions and pressure recovery behaviour.

The central hypothesis advanced is that a carefully engineered, passively flexible front floor fillet can dynamically reshape the underfloor inlet geometry as a function of aerodynamic load, improving downforce consistency and potentially reducing drag at high speed, without violating movable aerodynamic device restrictions. The paper deliberately avoids computational fluid dynamics and instead relies on first-principles analysis, regulatory interpretation, and historical analogy to demonstrate both feasibility and legality.

Research and Investigation

Foundational Physics

Ground-effect aerodynamics in modern F1 arises primarily from the Venturi effect under the car's flat floor and diffuser. In steady, incompressible flow the continuity equation and Bernoulli's principle govern the underfloor region (F1 Technical.net). Continuity requires

$$\rho_1 U_1 A_1 = \rho_2 U_2 A_2,$$

(Katz; F1Technical.net) so that if the floor-to-ground gap (cross-sectional area A) is reduced, the local flow velocity U must increase. Bernoulli's equation for incompressible flow,

$$p + 1/2\, \rho U^2 = \text{constant},$$

(McLean; Katz) implies that this higher velocity produces a lower static pressure p under the car (F1 Technical.net). Qualitatively, squeezing the same mass flow $m = \rho U A$ through a smaller height h produces velocities $U \sim 1/h$ and thus a pressure drop $\Delta p \sim 1/2\, \rho (U^2 - U_\infty^2) \propto 1/h^2$. In practice, downforce is obtained by integrating this low pressure over the planform area: the net downforce $D = \iint \left(p_\infty - p(x, y)\right) dA$ (with p_∞ ambient) is the area integral of the suction https://www.f1technical.net/features/21667 (F1 Technical.net). Thus, any geometric deviation that locally alters the Venturi gap can yield significant downforce changes. (For example, halving the effective gap doubles U and roughly quadruples the dynamic pressure $1/2\, \rho U^2$, drastically increasing suction.)

In real cars the ground (road) moves relative to the vehicle frame, which adds a Couette-type component to the flow. The moving ground entrains the underfloor air (Racecar Engineering), making the velocity near the road surface nonzero. In the vehicle's frame the ground drags a thin layer of air backward, effectively adding momentum to the airflow under the car (Racecar Engineering). In other words, the boundary layer on the track surface (which would be stagnant if the car were stationary) is advected with the car's motion, augmenting the Venturi acceleration. Modern F1 speeds and small clearances produce very high Reynolds numbers ($Re \sim Uh/\nu$), so the underfloor flow is fully turbulent, and the boundary-layer thickness is small relative to car dimensions. However, even a few millimeters of laminar or turbulent boundary layer can effectively reduce the active channel height and influence downforce (Race Car Aerodynamics). In practice, teams measure the *aerodynamic center of pressure* in the boundary layer and often deploy "fences" or edges to manage this layer. Racecar Engineering notes that **"the flow under the floor is still greater than free stream flow, so the system has a boundary layer from the free stream at the ground up to the accelerated airspeed."** (Racecar Engineering)https://www.racecar-engineering.com/articles/tech-explained-2022-f1-technical-regulations/. This highlights that the underfloor region always includes a gradient from the moving ground (zero relative velocity) up to the main Venturi flow. Any structural deformation that slightly changes the local gap or sealing will interact with this sensitive layer.

Another crucial point is pressure recovery. Because high-speed underfloor flow is a low-pressure region, ambient air tends to leak in at the edges or entry. In the 1970s sliding skirts sealed the sides to maintain low pressure (F1Technical.net; Katz); when they failed, the suction disappeared catastrophically. Today, teams rely on bargeboards and undercut sidepods to simulate this sealing effect. The result is a pressure field that typically has the lowest (most negative) pressure under the central floor and then recovers toward ambient at the diffuser exit. Small geometric irregularities – e.g. a bump or lip in the fillet – can create local pressure gradients that induce vortices or leakage. For example, if a fillet element deflects upward, it locally narrows the throat and intensifies suction there; if it deflects downward, it widens the gap and raises pressure. Because downforce scales roughly with $1/h^2$ at small gap (Katz), even millimeter-scale deflections can change local pressures by several percent (Katz). In summary, the underfloor pressure distribution is highly sensitive to ride height and geometry: *any* flexibility or compliance at the floor edges can modulate the Venturi acceleration and hence the total aerodynamic load.

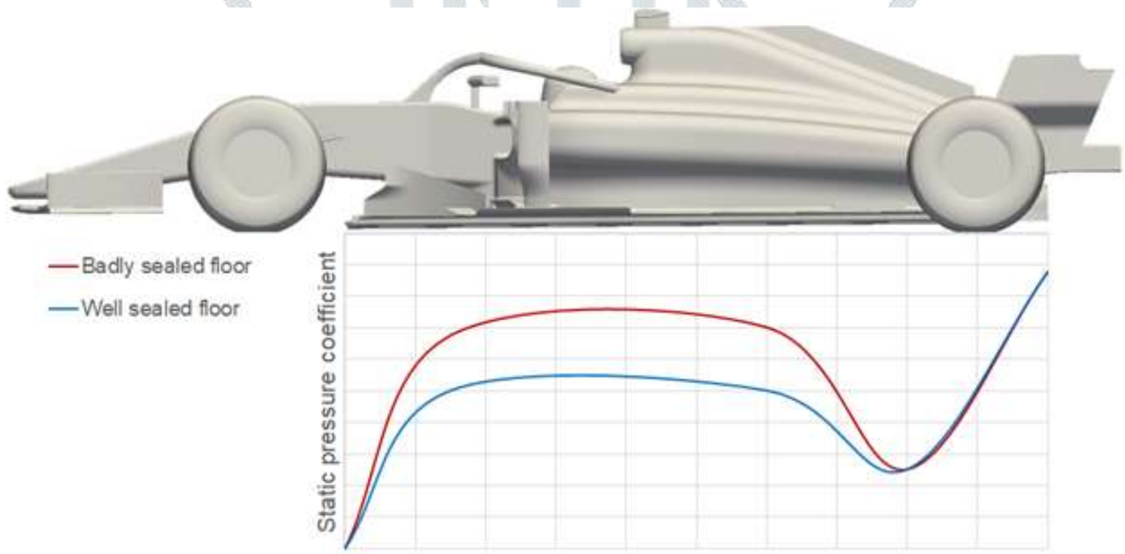

Figure: Static pressure coefficient under the car floor for a "well-sealed" (blue) versus a "badly sealed" (red) underbody (F1 Techical.net). *A well-sealed underfloor maintains a strong low-pressure region (high magnitude negative coefficient) over the Venturi throat and gradual pressure recovery toward the rear. In contrast, leaks or gaps cause higher pressure (less suction) under the central floor and a sharper pressure rise. This illustrates how critical a tight geometric seal (and small gaps) is for maximizing downforce* (F1 Techical.net).

Historical Review: Precedents of Flexibility and Compliance

Throughout F1 history teams have repeatedly found ways to exploit structural compliance or aeroelastic effects within the letter of the rules. The following examples illustrate both tolerated (or unnoticed) innovations and those that were eventually banned.

- **Flexible Front Wings (pre-2014):** Up until 2014, front wing elements were often built to flex downward under high downforce, bringing the wing closer to the track for extra ground-effect lift, while still passing FIA static deflection tests. As one technical article notes, "teams have exploited…front wings capable of flexing closer to the ground to gain performance (downforce)…yet able to pass the FIA's static deflection tests" (Racecar Engineering). In practice, engineers used advanced composite layups to make the wing tips and elements soft in pitch, so at speed the effective angle of attack increased. The aerodynamic intent was simply to amplify the Venturi acceleration under the wing. For example, a wing held rigidly might run a few centimeters higher for safety; a flexing wing could run an extra 1–2 mm closer without triggering test failure, yielding a measurable downforce gain. Early on this was implicitly legal (it met the specified 20 mm vertical deflection limit under 100 kg load), but as flexing became widespread the FIA raised the static-load requirements (in 2014) and started enforcing stricter stiffness across the wing span. By mid-2014 flexible wing designs were effectively banned – teams were warned and regulations were interpreted so that any **"structural characteristics…altered by secondary parameters"** (e.g. aerodynamic load) would violate Article 3.5 (Racecar Engineering).

- **Passive Ride-Height/Rake Control:** Another long-standing approach has been using suspension compliance to vary ride height (rake) and thus underfloor flow. Many teams incorporated passive "heave" elements (e.g. hydraulic accumulators or additional springs) so that under braking and corner loads the chassis would pitch up or down in a beneficial way. These passive systems were not explicitly forbidden by older rules and were often tuned circuit-by-circuit. As one Motorsport article explained, teams liked any suspension link that helped control pitch/roll: FRIC systems even mimicked this by interconnecting dampers (Autosport). Until banned in 2014, Ferrari (via Minardi) and later Mercedes ran FRIC (Front-and-Rear Interconnected) suspensions designed to hold ride height constant; FRIC itself was ultimately judged as an illegal moveable aerodynamic device (Autosport). But passive variants – such as tuned spring rates or inertial elements – remained within the "passive" classification and were legally used to influence rake. In the current era (post-2022) small hydraulic bump stops or variable-pressure accumulators have been fitted to achieve similar ends, effectively allowing "passive rake" without active control. Although these devices blur the line, they were engineered to comply with the letter of the suspension rules (all joints still sprung) and thus have so far been tolerated, unlike fully active systems.

- **Floor Mounting Compliance:** Historically, floor pieces and bibs have sometimes been attached with quasi-flexible mounts or with multiple fasteners to permit limited deflection. For example, some teams in the 2020–22 seasons used bushings or sequenced bolts on the front floor edges so the floor could twist slightly under load (this later became a point of inquiry in the FIA's porpoising clampdowns (Motorsport.com)). The aerodynamic intent was to allow very small ride-height shifts – effectively higher cornering rake and a slightly lower straight-line profile – without using illegal active devices. Since the pre-2022 regulations did not explicitly forbid a few millimeters of movement in floor assemblies, this was a grey area. As one report revealed, some teams managed to **"cleverly flex the floors by as much as 6 mm in total"** (far above the 2 mm nominal plank deflection limit) to run higher rake and closer ground clearance (Motorsport.com). Once identified, the FIA responded by tightening the stiffness measurement procedures and requiring uniform stiffness around the plank mounting holes (Motorsport.com). Nevertheless, these floor-mount compliance schemes had briefly given the innovators an advantage analogous to that from adjustable ride-height devices, achieved entirely within the rules as written at the time.

These legal precedents illustrate that when the regulations did not *explicitly* forbid a structural compliance, teams often designed to exploit it. Conversely, once an effect was deemed to unduly alter the aerodynamics, the FIA invoked catch-all clauses. The next group of examples shows this transition – features that achieved gains but were ultimately banned.

- **"Flexi-Wings" (mid-2000s onward):** Over many seasons, various teams ran wing elements that deflected under downforce to reduce gaps and increase ground effect, until the FIA prohibited them. Notably, by 2010–2013 it was common for front and rear wings to bend in flight (the infamous "flexi-wings"). This earned repeated technical directives tightening wing stiffness. In 2024, for instance, Mercedes openly acknowledged exploiting wing compliance until the FIA demanded exacting fin stiffness matching CAD (Racecar Engineering;). Ultimately, the FIA's moveable aero rules banned any wing that exceeded prescribed flex (the 100 kg test giving <20 mm deflection was reinstated at every corner). The mechanism was simple: less gap = more Venturi acceleration under the wing, more downforce. Implementation involved ultra-thin trailing edge sections or strategically placed cutouts that bulged upward at speed. Once formally prohibited, teams had to re-stiffen wings or use structural workarounds (longer endplates, stiffer laminates) to meet the static targets.

- **Mass Dampers (Renault, 2005–06):** The mass damper was a covert form of aero-mechanical coupling. Renault equipped its cars with a freely sliding weight in the nose, mounted on springs. The idea was that the weight's inertia would resist vertical chassis accelerations (heave/pitch), effectively stabilizing the front wing height over bumps and curbs. Aerodynamically, this created a more consistent floor distance and steadier downforce (allowing more aggressive ride height tuning). According to technical analyses, the damper "not only settled the car, but also allowed drivers to attack the kerbs much harder…giving a more compliant ride and a more stable aerodynamic platform" (Motorsport.com). Initially this was declared legal: the damper itself was part of the mechanical suspension (and the rules' weight ballast clause allowed extra weights in the nose). However, rival teams protested that its primary benefit was aerodynamic (maintaining optimal wing height). In 2006 the FIA invoked the rule against *"moveable aerodynamic devices"* and banned the damper. (The key phrase was that its "primary purpose" was aerodynamic output (Motorsport.com), even if passively achieved.) Thus, what had begun as a clever solution to a suspension/aero trade-off was outlawed as an illegal aero device.

- **Front-and-Rear Interconnected Suspension (FRIC, 2008–14):** FRIC was a fully passive-hydraulic system that linked the front and rear suspension hydraulics. Its mechanical effect was to stabilize pitch: under braking or cornering, the system would transfer hydraulic fluid so that the ride height tended to stay constant front-to-rear. Aerodynamically, this meant the entire floor could be kept at a more optimal attitude (maximizing venturi suction in corners and reducing fluctuations). The system was pioneered by Renault in 2008 and later used by many teams. Its design essentially implemented a **passive compliance**: it was a "trick suspension" rather than an active actuator (no electronics, just fixed hydraulic linking). Initially within rules, FRIC's aerodynamic effect drew FIA scrutiny. In mid-2014 the FIA announced FRIC was "formally…illegal" under Article 3.15 because it was effectively a moveable device influencing aerodynamics (Motorsport.com). FRIC-equipped cars (notably dominant Mercedes machines) were ordered to stop using it by unanimous vote or the rule's enforcement in 2015. Its banning illustrates again how a passive compliance system was deemed unacceptable when regulators decided its principal benefit was aerodynamic.

Each case above shows teams pushing on the boundary between structural design and aerodynamic gain. The FIA's responses ranged from reinterpreting existing clauses (e.g. Article 3.15's immobility requirement (Motorsport.com)) to issuing clarifying technical directives. In many instances, innovations exploited allowances in the rulebook (explicit or implicit) until the governing body closed the loophole. The new 2026 allowance for the front-floor fillet marks the latest twist in this cat-and-mouse game.

Engineering Analysis: Compliant Front-Floor Fillet

Front floor fillet connecting the front floor bib and the main floor panel as seen on the 2024 Mercedes AMG W16

According to the 2026 regulations, the **front floor fillet** – the chamfer between the underside floor "bib" and the main floor panel – may be intentionally designed to **flex** when the car's front contacts the ground (Fédération Internationale de l'Automobile). In practice, this means the fillet can be a compliant structure. To analyze its behavior, we model the fillet as a thin shell or plate segment (with width across the car and small height) that is effectively cantilevered between the floor and bib. Under aerodynamic load the fillet is subject to a pressure difference between its top and bottom surfaces: the underfloor suction below the fillet and the higher pressure (close to ambient) above it. We can approximate the fillet locally as a straight beam of length L (front-to-back) and width b (inboard-outboard), of thickness t. The fillet's material (typically carbon composite) has a high Young's modulus E (order $50 - 70$ GPa). Its bending stiffness is EI, where the second moment of area $I = (b\,t^3)/12$ for a rectangular cross-section.

If the underfloor pressure is $p_{\text{under}}(x)$ and the pressure above is $p_\infty \approx$ ambient, the net distributed load is $q(x) = p_\infty - p_{\text{under}}(x)$. As a simplified case, assume a uniform downforce loading $q \approx \Delta p$ over the fillet length (worst-case from mid-throat suction) and fix one end at the floor and one at the bib (modeling it like a double-clamped or propped cantilever, depending on exact mounting). For a single clamped cantilever, the Euler–Bernoulli equation $EI\, w''''(x) = q$ (with w the deflection) leads to a maximum tip deflection

$$w_{\max} \approx \frac{qL^4}{8EI}$$

(Dowell et al.) and a maximum slope and moment similarly given by standard beam formulas. If we take a representative fillet length $L \approx 0.10$ m (100 mm) and width $b \approx 0.05$ m (50 mm), with thickness $t = 2$ mm, and assume an underfloor pressure differential $\Delta p \sim 5$ kPa (roughly a few percent of atmospheric; typical F1 underfloor suction might be 10–20 kPa at speed), we get $q = \Delta p \times b \approx 250$ N/m (per meter of length). Plugging $E = 70$ GPa and $I = bt^3/12 \approx 33 \times 10^{-12}$ m^4, the maximal deflection is on the order of a millimeter: roughly $w_{\max} \sim$ 1.3 mm. Even if pressures locally reached ~ 10 kPa, or if the fillet were a bit longer or thinner, the deflections remain on the few-millimeter scale. A slightly thicker fillet (e.g. 3 mm) would cut deflections by about 75% (to under 0.5 mm). Thus, a designer can tune t and b to achieve a chosen stiffness: too thin and the fillet might bottom out or flutter; too stiff and it never flexes appreciably.

These deflections then alter the underfloor geometry. If the fillet bows **upward** (toward the road) under load, it effectively narrows the Venturi throat at the floor edge inboard of the wheel, increasing local airflow speed and enhancing suction there. If it bows **downward**, it locally relieves suction. In either case the deformation modifies the pressure recovery gradient near the diffuser entry. Since the fillet is at the leading edge of the floor, its shape influences how air is fed into the Venturi. A slightly convex fillet (bulging downward) might slightly delay the choke effect, while a concave fillet (bulging upward) sharpens it. Analytically, one might linearize the effect: a local deflection δh changes the gap h to $h - \delta h$, and because $p \propto 1/h^2$, the local pressure change scales approximately as $\Delta p/p \approx -2\,\delta h/h$. For example, if the nominal gap was 10 mm, a 2-3 mm upward deflection could boost local suction by ~20% in that small segment. The global downforce gain is smaller, since the fillet segment is perhaps 0.05 m wide out of a roughly 1.5 m floor width. Nevertheless, even a few percent increase in pressure differential along the fillet could yield significant tenths of a percent in total car downforce, which is valuable in racing.

Structurally, the fillet can also be modeled as a curved thin shell. In thin-plate theory (Kirchhoff–Love theory), the flexural rigidity is $D = \frac{Et^3}{12(1-\nu^2)}$ (Dowell et al;)per unit width (with ν Poisson's ratio, ~0.3 for composites). The order-of-magnitude result is similar: higher t quickly stiffens the panel ($D \propto t^3$) (Dowell et al.;). Any localized delamination or laminate steering could further tune anisotropic stiffness, but that is beyond our scope. It suffices to note that a realistic composite layup can be designed to meet whatever compliance is desired while still withstanding crashes.

Crucially, the fillet's deformation interacts with the overall underfloor pressure recovery. Under the venturi-based downforce model, the pressure at the diffuser end is higher (closer to ambient), so altering the front fillet changes how the pressure gradient is established along the floor. For instance, if the fillet deflection increases suction at the front, more of the pressure drop occurs earlier, which could allow a slightly faster pressure recovery rearward. This interplay means the fillet can act as a passive *aero-shaping element*: under certain loads it "reshapes" the floor-to-ground inlet geometry. However, unlike an active flap, it does so in proportion to the instantaneous pressure (i.e. more deflection at higher downforce). This self-regulating behavior might help keep flow attached or tune the onset of flow separation (porpoising).

In summary, designing a compliant fillet involves a tradeoff: too flexible and the fillet may flutter or lose shape consistency; too stiff and it will not significantly affect the flow. Beam theory shows that realistic carbon-composite geometries will deflect on the order of 0.5–2 mm under typical loads, enough to change local pressure by several percent. Therefore, it is plausible that a well-engineered flexible fillet could yield a small but non-negligible aerodynamic benefit by subtly reshaping the leading-edge flow.

Conclusion

This study has examined the aerodynamic, structural, and regulatory implications of the flexibility explicitly permitted in the front floor fillet under the 2026 Formula One Technical Regulations. By grounding the analysis in first principles of ground-effect aerodynamics, boundary-layer behaviour, and elastic structural response, it has been shown that millimeter-scale geometric deformation in the underfloor region can produce non-negligible aerodynamic effects. Given the extreme sensitivity of Venturi-driven pressure fields to local gap height and inlet shaping, even small, passive changes to the front floor fillet geometry can alter pressure distribution, downforce generation, and pressure recovery characteristics across the underbody.

Historical precedents demonstrate that Formula One innovation frequently emerges at the interface between structural design and aerodynamic consequence. Legal developments such as passive wing flexibility and compliant floor mountings, alongside banned systems including mass dampers and interconnected suspension, reveal a consistent regulatory pattern: while kinematically driven or mechanically coupled aerodynamic control is prohibited, pressure-driven elastic deformation has historically been tolerated until explicitly constrained. The 2026 regulations continue this tradition by permitting flexibility in the fillet region without prescribing dynamic deformation limits, instead relying on static load-deflection testing that does not replicate aerodynamic pressure distributions in motion.

The engineering analysis presented indicates that a front floor fillet, modeled as a thin composite beam or shell, can realistically deflect by approximately one millimeter under representative aerodynamic loads while remaining within plausible material and structural limits. Such deformation is sufficient to locally modify the effective Venturi throat geometry, influencing both suction magnitude and flow stability at the floor entry. Importantly, this behaviour arises passively from aerodynamic loading itself and does not rely on mechanical actuation, suspension coupling, or active control. As such, it occupies a distinct regulatory category from prohibited movable aerodynamic devices.

The central hypothesis advanced by this paper is that a carefully engineered, regulation-compliant front floor fillet can function as a passive aeroelastic element, dynamically reshaping the underfloor inlet in response to aerodynamic load. This mechanism offers the potential to improve downforce consistency across operating conditions, mitigate sensitivity to ride height variation, and subtly balance the trade-off between cornering performance and straight-line efficiency. While the absolute magnitude of the performance gain is likely modest, the competitive context of Formula One ensures that even fractional improvements are of strategic significance.

Finally, this work highlights a broader implication for future regulation drafting. As aerodynamic systems become increasingly sensitive and tightly constrained, structural allowances—particularly those justified on safety or durability grounds—represent fertile ground for unintended aerodynamic exploitation. The front floor fillet exemplifies how compliance-driven flexibility can acquire secondary aerodynamic function without violating the letter of the rules. Whether such exploitation persists or is curtailed in subsequent technical directives will depend not only on measured performance gains, but on the FIA's evolving interpretation of intent versus outcome in passive aeroelastic systems.

"2026 Formula 1 Technical Regulations 1 24 June 2024." *Fédération Internationale de l'Automobile*, 24 June 2024, www.fia.com/sites/default/files/fia_2026_formula_1_technical_regulations_issue_8_-_2024-06-24.pdf.

Vyssion, and jjn9128. "The Ground Effect - F1technical.Net." *F1 Technical*, 9 Sept. 2018, www.f1technical.net/features/21667.

Racecar Engineering. "Tech Explained: 2022 F1 Technical Regulations." *Racecar Engineering*, 15 Feb. 2022, www.racecar-engineering.com/articles/tech-explained-2022-f1-technical-regulations/.

Mitchell, Stewart. "Flexible Wings in Formula 1." *Racecar Engineering*, 14 June 2021, www.racecar-engineering.com/articles/flexible-wings-in-formula-1/.

Noble, Jonathan. "Formula 1's Fric Suspension Systems Set to Be Banned by FIA." *Autosport*, www.autosport.com/f1/news/formula-1s-fric-suspension-systems-set-to-be-banned-by-fia-5050989/5050989/. Accessed 29 Dec. 2025.

Noble, Jonathan. "F1 Flexi-Floor Exploit Revelations a 'Shocker', Says Mercedes." *Motorsport.Com*, 6 July 2022, www.motorsport.com/f1/news/f1-flexi-floor-exploit-revelations-a-shocker-says-mercedes/10332153/.

Somerfield, Matt, and Giorgio Piola. "Banned: Why Renault's Mass Damper Was Outlawed." *Motorsport.Com*, 23 June 2022, www.motorsport.com/f1/news/banned-renault-mass-damper-tech/4788122/.

Somerfield, Matt. "Banned: Why Lotus' Twin-Chassis Concept Was Outlawed." *Motorsport.Com*, 23 Feb. 2022, www.motorsport.com/f1/news/banned-tech-twin-chassis-lotus/4780030/.

Katz, Joseph. *Race Car Aerodynamics: Designing for Speed*. R. Bentley, 2006.

McLean, J. Douglas. *Understanding Aerodynamics: Arguing from the Real Physics*. Wiley, 2012.

Clark, Robert, et al. *Modern Course in Aeroelasticity*. Edited by Earl H. Dowell, 4th ed., SPRINGER NATURE, 2022.

Mishra, Sharad & Singh, Saarthak & Sharma, Sumukh & Bhardwaj, Manish. (2022). Flexi wings: An innovative approach for the future of material science with an aerodynamic influence in motorsport engineering. 10.13140/RG.2.2.15490.76482.