FEV Signature Solutions

Single-Track Vehicle Dynamics

Elevate your ride: Advanced dynamics for single-track vehicles

FEV offers

- **Advanced multi-body simulation and virtual prototyping** — accelerate development, cut costs, and optimize performance.
- **Modular, customizable chassis and cockpit frameworks** — adapt solutions to your needs and vehicle types.
- **Data-driven benchmarking and target setting** — achieve measurable gains in safety, comfort, and performance.
- **Integrated software for active safety and AI-based rider modeling** — enhance rider protection and deliver intelligent, future-ready control.

Why FEV

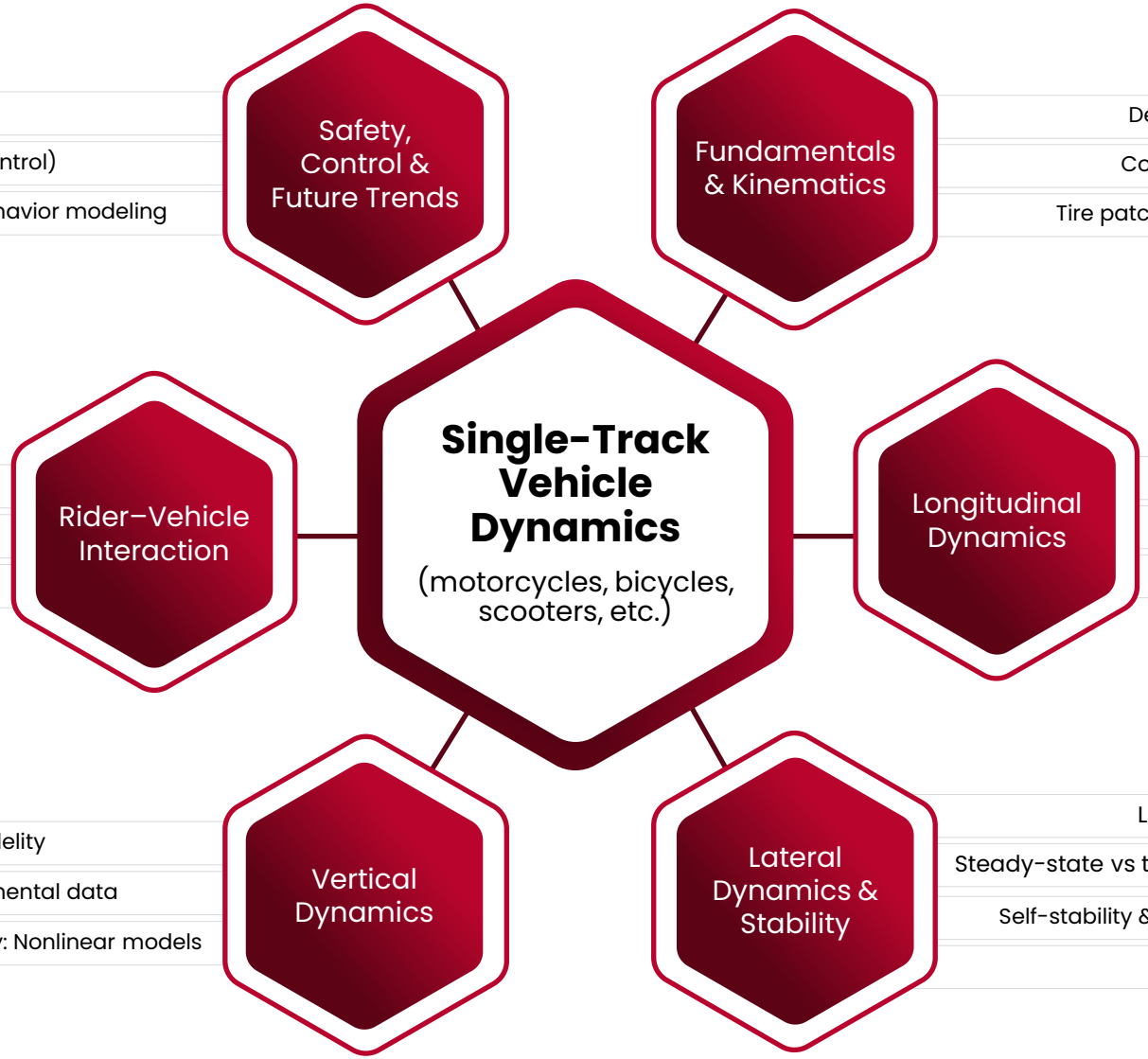
- Extensive track record in delivering innovative solutions for global OEMs and mobility leaders.
- Open engineering approach—sharing simulation models, validation data, and technical insights with customers.
- From concept to series production, FEV partners with you at every stage, ensuring knowledge transfer and project success.

Reference Project

Measurement of Dynamics of an E-Motorbike

- Constant Turning Radius
- Highway
- Slalom

Single-Track Vehicles
Vehicle Dynamics Development Scope



- Accident scenarios and countermeasures
- Active safety (ABS, traction control, stability control)
- Autonomous/self-balancing: AI/ML in rider behavior modeling

- Definition and characteristics: Benchmarking & Target Setting
- Coordinate systems and reference frames: Degree of freedom
- Tire patch, rolling constraints, path curvature and trajectory tracking

- Rider biomechanics and control inputs
- Rider lean and body steering effects
- Rider–in-the-loop modelling

- Balance of forces (aerodynamic drag, rolling resistance)
- Acceleration (traction circle, weight transfer)
- Braking dynamics (front/rear brake distribution, ABS)

- Suspension models: Reduced order vs high-fidelity
- Pitch and ride comfort: Validation with experimental data
- Influence of suspension on handling & stability: Nonlinear models

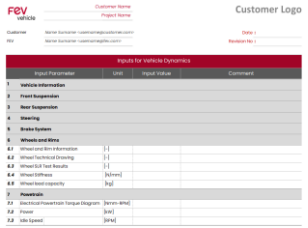
- Lean angle and roll dynamics: Counter-steering principle
- Steady-state vs transient cornering: Centripetal force & stability in curves
- Self-stability & rider stabilization: Low-speed wobble & high-speed weave
- Effect of mass distribution and wheel gyroscopic forces

Vehicle Dynamics Development
Solution Strategy

Inputs

Input Parameters List

- Ensures all critical vehicle data is captured for accurate single-track dynamics prediction.
- Reduces customer iteration effort by structuring inputs around key performance needs.



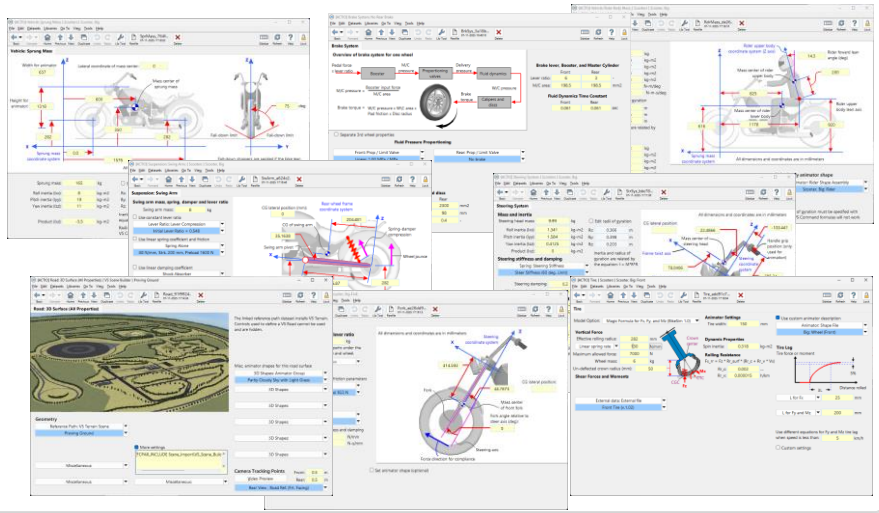
Benchmark & Testing Support

- Delivers data-backed comparison against market references to guide competitive performance targets.
- Gives customers confidence via traceable test evidence aligned with real-world riding conditions.

Method

Modelling & Boundary Conditions

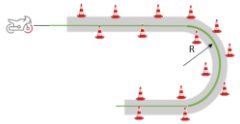
- Enables rapid evaluation of design alternatives with high-fidelity single-track simulations.
- Reduces development risk by predicting handling behavior early in the design phase.
- Shortens project timelines through repeatable, automated simulation workflows.
- Defines realistic operational limits so customers receive trustworthy, ride-relevant predictions.
- Improves model accuracy by aligning conditions with expected rider profiles and environments.

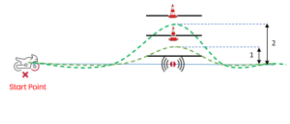


Outputs

Measurement Maneuvers

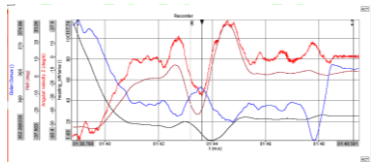
- Providing clear maneuver-level insights (e.g., slalom, braking, lane change) tailored to customer goals.
- Quantifies dynamic responses so customers can compare concepts with objective metrics.
- Transforms complex behaviors into digestible data that supports targeted performance improvements.





Results

- Presents graphs and screenshots that give immediate visual understanding of performance trends.
- Supports decision-making with transparent, simulation-based evidence ready for documentation or reviews.



Get in touch with us for further information

www.fev.com/en/signature-solutions