WIM SITE – ROAD QUALITY STANDARDS AND PARAMETERS

WIM, high-accuracy GVW applications structural pavement properties, surface pavement properties

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Foreword

This document focuses solely on road properties, and it defines the minimum structural and surface parameters required for the installation of a high-accuracy WIM site.

At least four influencing factors at various levels determine the performance and accuracy achievable at a WIM site.

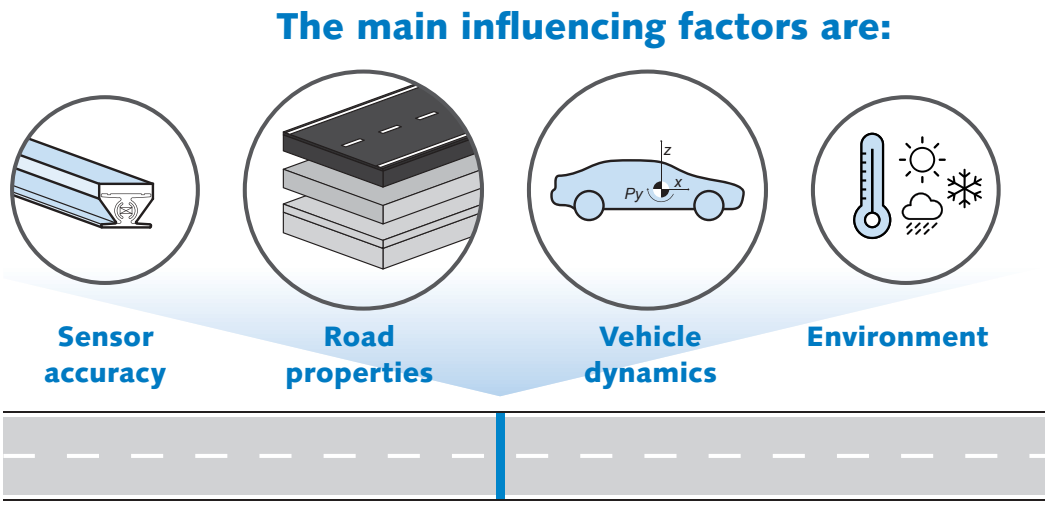

Fig. 1: The four influencing factors

Asphalt pavement recommendations

Overall pavement stiffness is crucial for WIM enforcement applications, and an equivalent elastic modulus of **1,180 MPa** is required. To provide support and guidance for assessing or re-establishing proper pavement conditions, the table below shows pavement layer properties suitable for WIM enforcement applications.

Asphalt pavement layers	Elastic modulus range	Remarks
Top/asphalt layer (AC, asphalt concrete)	E1 = 5,500 – 11,000 MPa Coefficient of variation <20%	▪ Detailed specification according to regional design requirements ▪ Recommendation: close to higher range ▪ Thickness: 160 to 200 mm
Middle/base layer	E2 = 770 – 1,400 MPa Coefficient of variation <20%	▪ Detailed specification according to regional design requirements ▪ Recommendation: close to higher range ▪ Thickness: 150 to 200 mm
Subgrade	E3 = 120 – 175 MPa Coefficient of variation <20%	▪ According to the Unified Soil Classification System (USCS) ▪ Recommendation: close to higher range ▪ Thickness: 200 to 300 mm

Additional requirements

When performing Falling Weight Deflectometer (FWD) test:

- Deflection difference (Y1), right / left wheelpath , shall be ≤ ±50 µm
- Minimum deflection (Y1), measured: ≥200 µm
- Distance between FWD measurement points = 5 m (zigzag right/left wheelpath)
- FWD test section as per Figure 2

Table 1: Indicative values for sufficient asphalt pavement layers

The table is indicative; it does not provide a formal specification or specific design data, because the number of asphalt concrete (AC) layers can vary depending on the functional requirements in the specific region or country. The contractor/agency should determine the required layer properties according to the design standards and guidelines of the country or region concerned.

Various factors come into play, including:

- Soil condition as quantified by the resilient modulus (Mr)
- Traffic as quantified by equivalent single axle loads (ESALs)
- Pavement condition as quantified by a change in pavement serviceability index (ΔPSI)
- Pavement structure as quantified by a structural number (SN)

The recommended length of paved road section to meet the required properties is ideally reaching 200 m, as shown in detail in the figure.

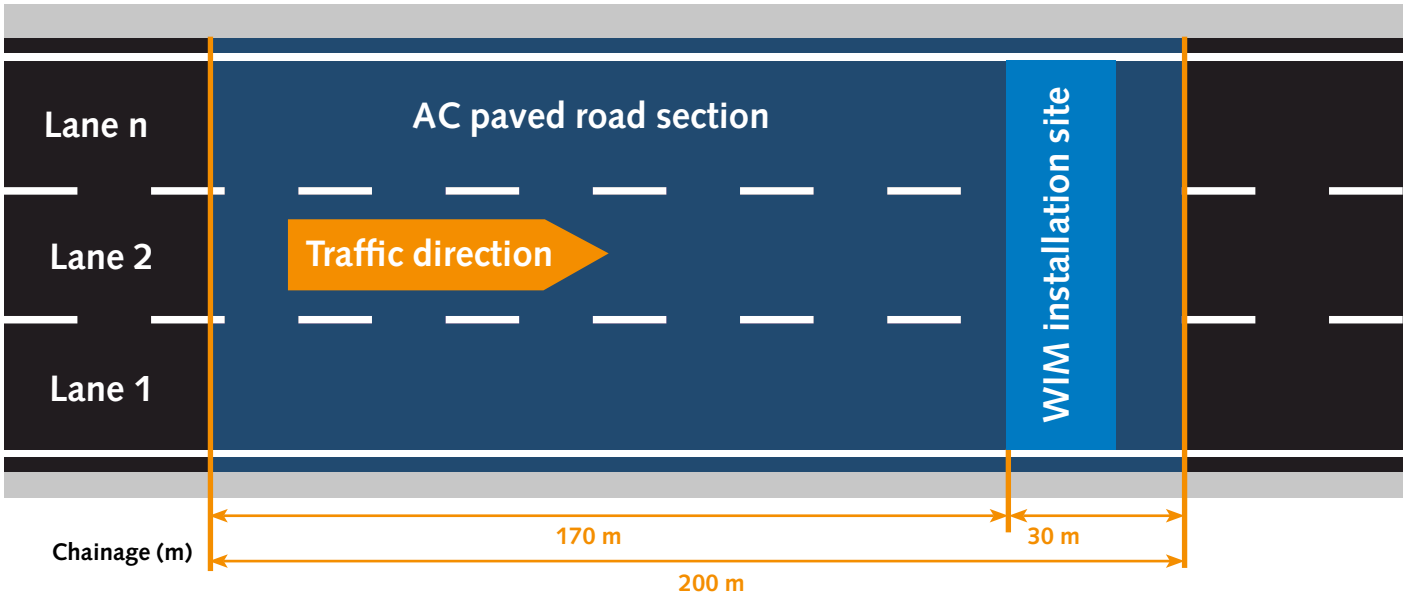

Fig. 2: AC pavement road length recommendation

Concrete pavement recommendations

The concrete pavement structure is generally dependent on the traffic index, climate condition, soil conditions, and desired design life. The thickness of the concrete layer is highly dependent on the performance/type of the base and subgrade material, which requires laboratory testing. The following recommendation is shown as an example, and should not be taken as a general specification.

The main layer of concrete road and the expected elastic modulus of the layer are shown in the table below. The concrete layer can be made from jointed plain concrete pavement (JPCP), jointed reinforced concrete pavements (JRCP), and continuously reinforced concrete pavements (CRCP).

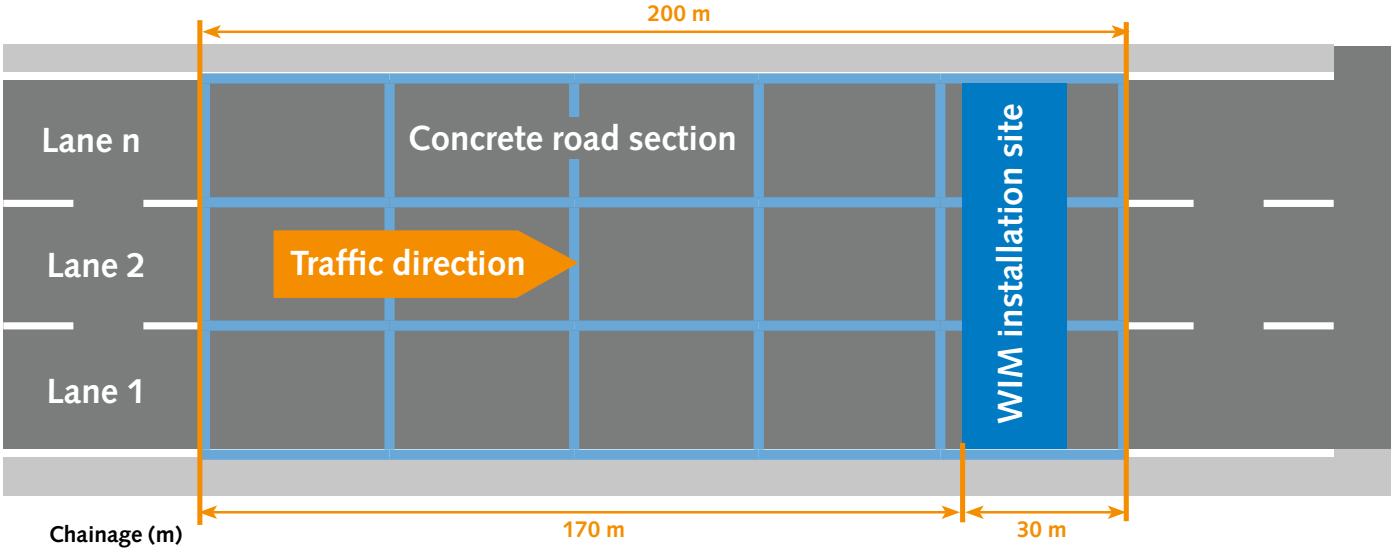

Fig. 3: Concrete pavement road length recommendation

Concrete pavement layers	Elastic modulus range	Remarks
Concrete road layer(s)	E1 ≥40,000 MPa	▪ Coefficient of variation <20% ▪ Thickness 250–300 mm
Base layer	E2 ≥240 MPa	▪ Coefficient of variation <20% ▪ Thickness: approx. 150–300 mm (depending on the design requirements and materials) ▪ It is advisable to define the base layer thickness accurately, based on the subbase (optional) and subgrade material properties, and the traffic index.
Subgrade	E3 ≥84 MPa	▪ Coefficient of variation <20% ▪ Mr (soil condition as quantified by the resilient modulus) >175 MPa. ▪ Cement-stabilized material or frost blanket can be used, depending on the regional design requirements. ▪ A frost blanket is built from unbound mineral and aggregates, usually in the form of graded aggregate with a low fines content . Once they have been fully compacted, frost blankets must be sufficiently permeable to water and have an anti-capillary effect. This prevents water from rising into the pavement, ultimately preventing damage to the superstructure.

Additional requirements

- Load transfer efficiency >80%
- FWD measurement layout – 5 points per slab (middle, approach R path, leaving R path, approach L path, leaving L path)
- Longitudinal expansion joints must be precisely positioned between separately placed adjoining lanes.
- Concrete pavement should be avoided through extensive areas of expansive soils with a plasticity index (PI) >12 due to the potential for significant non-uniform differential settlement, lateral movement, and resulting costly maintenance repairs.

Table 2: Indicative values for sufficient concrete pavement layers

Road geometry

Measurements are influenced not only by the structural behavior of the road, but also by its geometry. Driver behavior is heavily influenced by the surrounding environment, resulting in inaccuracies due to acceleration or deceleration. Behavior of this sort must be prevented.

Parameter	Value
Minimum distance from object	>500 m Note: may be less when average speed at site <80 km/h
Transversal slope	<3%
Longitudinal slope	<2%
Curvature	>2,000 m
IRI (1 m resolution)	<2.6 mm/m
Rutting (each wheelpath separately)	2 mm

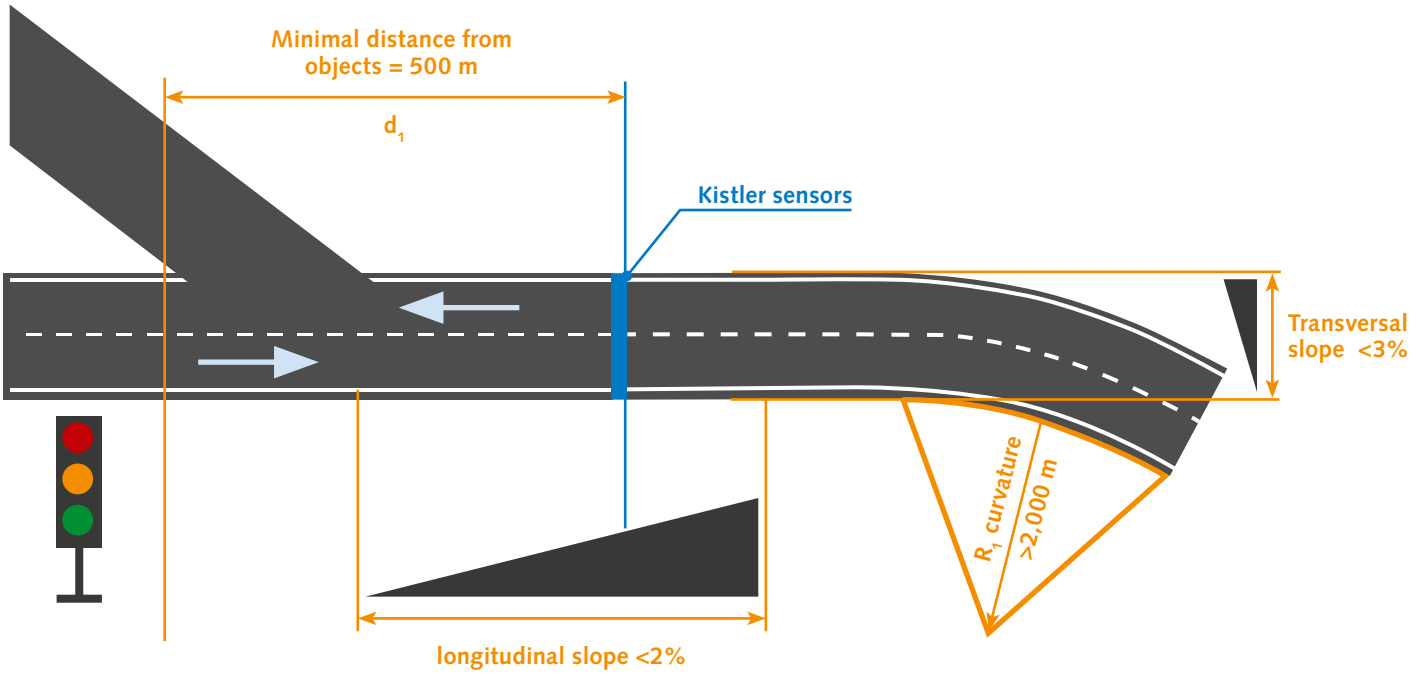

Fig. 4: Recommended road geometry parameters

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