



**transport**

Department:  
Transport  
REPUBLIC OF SOUTH AFRICA

# **SMART TRUCK PROGRAMME**

## **RULES FOR THE DEVELOPMENT AND OPERATION OF SMART TRUCKS AS PART OF THE PERFORMANCE-BASED STANDARDS RESEARCH PROGRAMME IN SOUTH AFRICA**

(Version 33)

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Compiled by:

**Smart Truck Review Panel and  
CSIR Smart Mobility**



## 1 Introduction

In most countries throughout the world, heavy vehicle use on the road network is controlled predominantly by prescriptive regulations. These regulations, in many cases, differ significantly from one country to another. Efforts in various parts of the world (including the SADC Region) to achieve regional harmonisation and effective road use have had limited success. Another approach is to consider performance-based standards (PBS); in this case standards specify the performance required from the operation of a vehicle on a network rather than prescribing how the specified level of performance is to be achieved. This approach allows more flexibility for vehicle designers to utilise innovative solutions and the latest available technology to meet the required performance standards with improved safety outcomes and more effective use of the road infrastructure. The PBS approach also allows a more optimum match between the PBS vehicle and the road infrastructure (roads and bridges) which it uses. Heavy vehicles operated under a PBS framework are typically limited to travel on a subset of the network to ensure protection of the road infrastructure and acceptable safety levels. As a result of initiatives in Australia, New Zealand and Canada, the application of performance-based standards in the heavy vehicle sector in South Africa was identified by the CSIR as a research area warranting Parliamentary Grant funding because of the potential benefits in terms of transport efficiency, road/vehicle safety and the protection of road infrastructure.

As part of the Smart Truck research programme, a need was identified to design, manufacture and operate a number of PBS demonstration projects in South Africa in order to gain practical experience in the performance-based standards approach for heavy vehicles and to quantify and evaluate the potential safety and productivity benefits of this approach to road freight transport. The fleets of participating operators of these vehicles are required to be accredited through the Road Transport Management System (RTMS) self-regulation programme.

The vehicle performance standards that have been used to design PBS demonstration vehicles cover high and low speed directional, stability and longitudinal performance measures such as Startability, Gradeability A, Gradeability B, Acceleration Capability, Frontal Swing, Maximum of Difference, Difference of Maxima, Tail Swing, Low-Speed Swept Path, Steer-Tyre Friction Demand, Tracking Ability on a Straight Path, Static Rollover Threshold, Rearward Amplification, Yaw Damping Coefficient and High-Speed Transient Offtracking.

## 2 Application process

The following process is required to be followed in order for an interested party to participate in the Smart Truck Programme - refer to Annexure A for a more detailed guideline.

### 2.1 Certification in terms of the Road Transport Management System (RTMS)

RTMS certification (in terms of the SABS national standard SANS 1395 Part 1:2014) of the fleet in which the proposed Smart Truck(s) will operate is required for a minimum of six months prior to the commissioning of the Smart Truck(s). This requirement is to ensure that the transport

operator, and in particular the relevant fleet, is being managed and operated in accordance with prescribed minimum safety and loading standards.

## 2.2 Application for Concept Approval and Principle Approval (if required)

The first step in a Smart Truck demonstration project is to identify one or more concept designs and to identify the proposed routes on which the Smart Truck(s) would operate. The concept design must indicate key dimensions, axle and axle unit masses of the vehicle combination. The applicant must also indicate the commodity/commodities to be transported. If the proposed vehicle is a Level 2 or higher in terms of the Australian requirements for PBS vehicles, a detailed description of the route(s) on which the proposed vehicle will operate, must be provided i.e. the entire route(s) must be described from origin to destination. Final approval of the application will be limited to the approved route(s).

Once the above information has been compiled, the applicant is required to submit a letter requesting Concept Approval to the relevant Provincial Abnormal Load Permit Office(s). Should one or more of the vehicles making up the PBS vehicle combination not comply with the National Road Traffic Act Regulations, Principle Approval is also required from the national Department of Transport as per the Abnormal Load process. Copies of these letters of application must be submitted to the Chairman of the Smart Truck Review Panel.

Depending on the overall length and combination mass of the proposed PBS vehicle and/or the routes on which the vehicle is proposed to operate, the Provincial Road Authority may, at its discretion, require additional information at the concept approval stage. Such information could include: a Traffic Impact Assessment by a Registered Professional Traffic Engineer and/or Geometric Design Impact by a Registered Professional Geometric Design Engineer of parts of or the whole route that are of concern from a Traffic/Geometric Design/Infrastructure perspective, the bridge assessment and the road wear assessment. Provincial Road Authorities may require upgrades to the road geometrics and access standards prior to the commencement of the operation of PBS vehicles.

Concept Approval is generally given for a period of five years, subject to the renewal of the annual PBS Exemption Permits. This is to enable the operator to recover the capital investment of the Smart Truck. However, non-compliance of the permit conditions may result in the withdrawal of the Exemption Permit (see Annexure B).

The following documents must be submitted with the application for concept approval:

- General arrangement drawing of the proposed PBS vehicle indicating key dimensions and masses
- Valid RTMS certificate
- Route map(s) for Level 2, 3 and 4 PBS vehicles

The definitions of Level 1, 2, 3 and 4 as applied to South African roads are:

1. Level 1: All public roads allowing access to vehicles up to the size of an 18.5 m tractor semitrailer.
2. Level 2: Public roads allowing access to vehicles up to the size of a 22.5 m B-double. The B-double requires a Low-Speed Swept Path no greater than 8.7 m to negotiate a 90 degree turn i.e. the vehicle cuts into the opposite lane, the Tail Swing is no greater than 0.35 m and the Tracking Ability on a Straight Path is no greater than 3.05 m. The routes are typically national highways with short and wide portions from the highway to the depo.
3. Level 3: Privately owned or remote lightly trafficked routes allowing access to vehicles up to 36.5 m road trains. A road train requires a Low-Speed Swept Path no greater than 10.6 m to negotiate a 90° turn, the Tail Swing is limited to 0.35 m, and the Tracking Ability on a Straight Path is limited to 3.15 m
4. Level 4: Privately owned or remote lightly trafficked routes allowing access to vehicles up to 53.5 m road trains. A road train requires a Low-Speed Swept Path no greater than 13.7 m to negotiate a 90° turn, the Tail Swing is limited to 0.5 m and the Tracking Ability on a Straight Path is limited to 3.35 m.

In cases where a truck or trailer manufacturer wishes to develop a PBS vehicle combination (to market to potential customers), concept approval is not required and the PBS assessments may be carried out and submitted to the Review Panel without a letter of concept approval or proof of RTMS certification. However, **Concept Approval letters (per province) and RTMS-certification will have to be obtained by each transport operator wishing to purchase any pre-approved PBS combinations.**

### 2.3 Detail design and assessment

On receiving a letter of Concept Approval from all the relevant Provinces and a letter of Principle Approval from the national Department of Transport (if required), the applicant may proceed with a detail design of the proposed vehicle combination followed by the following PBS assessments:

- Bridge and road wear assessment (if the maximum combination mass exceeds 56 tonnes)
- Safety assessment in terms of the Australian National Heavy Vehicle Regulator's PBS assessment requirements (NTC, 2020).

#### Road wear assessment

The PBS road wear assessment report must demonstrate that the proposed Smart Truck does not cause excessive road wear. The original requirement was that the PBS vehicle must cause less road wear per ton of payload than the "baseline" vehicle combination that is currently operational and that the PBS vehicle will replace. This is determined by calculating the Load Equivalency Factor (LEF) per ton of payload of the proposed PBS combination and the baseline vehicle combination based on the Mechanical-Empirical methodology that is the basis of the SA Pavement Design Manual. The baseline vehicle must be a realistically efficient standard legal vehicle combination for the freight task in question.

Sufficient data have now been collected to specify a maximum limit of the LEF per ton of payload, irrespective of the road wear characteristics of the baseline vehicle. Based on the

current eight typical SA pavements that are being used for the road wear assessment, the proposed PBS vehicle must have an LEF per ton of payload of less than or equal to 0.2. There are two exceptions:

- Rigid truck and drawbar combinations must have an LEF per ton of payload of less than or equal to 0.25
- Tractor semi-trailer combinations with quad axle semi-trailers must have an LEF per ton of payload of less than or equal to 0.38 with the provision that the PBS vehicle must have a lower LEF/tonne of payload than the equivalent the baseline vehicle. Over and above the improved road wear requirement for PBS vehicle designs, applicants (transport operators, consignors, manufacturers) will be required to explore the feasibility of using dual tyres in the quad where practically possible.

Additional exceptions to the 0.2 LEF/ton payload limit may be reviewed by the Review Panel on a case-by-case basis, depending on the road wear characteristics of the baseline vehicle and other supporting factors.

#### Bridge (structure) assessment

If the proposed PBS Level 2, 3 or 4 Smart Truck does not comply with Regulation 241 of the NRTR (the “legal” bridge formula) (DoT 2013), an Abnormal Load Bridge Formula (ALBF) (DoT, 2010) assessment must also accompany the application. The ALBF assessment should ensure a minimum factor of safety of 30% for the proposed Smart Truck unless the route on which the Smart Truck(s) will operate either have no structures or the structure are limited such that a more detailed assessment can be done based on actual bridge and culvert span lengths and/or actual bridge design loads e.g. TMH7 NC loading. In terms of the revised (first principle) approach for assessing structures, the Bending Moment Factor may not exceed 0.85 and the Shear Force Factor may not exceed 0.85. Should either of these factors be exceeded, a more detailed assessment (route clearance) will be required. Level 1 (General Accessibility) Smart Trucks must comply with Regulation 241 of the NRTR, the “legal” bridge formula.

#### Safety assessment

The PBS safety assessment must be carried out by a PBS assessor accredited by either the Australian or South African PBS Review Panels. See <https://www.nhvr.gov.au/road-access/performance-based-standards/useful-contacts>. The safety assessment must be based on the Australian National Heavy Vehicle Regulator’s PBS assessment requirements (NTC, 2020). However, some changes in the performance standards have been implemented to accommodate the road geometry and heavy vehicle regulations in South Africa, which vary from those in Australia. The following deviations from the Australian PBS assessment rules apply:

- Tail Swing (TS): The Tail Swing standard was amended to be measured relative to the widest point on the truck tractor body, and not relative to the entry tangent. The rigorous interpretation of the Australian PBS assessment rules requires the tail swing to be evaluated from the entry tangent of the reference point in question, which penalises combinations with narrow tractors or steer track width.

- Tracking Ability on a Straight Path (TASP). The Australian TASP performance criteria are relaxed by 0.05 m for each PBS level. (The primary reason is that in South Africa the permissible maximum width of a heavy vehicle is 2.6 m compared with a maximum width of 2.5 m in Australia. In addition, South Africa generally has wider vehicle lanes compared with Australia).
- Maximum of Difference (MoD) and Difference of Maxima (DoM). The performance levels for MoD and DoM in Australia are closely aligned to their vehicle regulations and were found to be unduly conservative for South African heavy vehicle designs (truck tractor/semi-trailer combinations). A review (Kienhöfer *et al.*, 2016) found that the Australian regulations in this regard are one of the most conservative worldwide. The Smart Truck Review Panel approved the recommendation to relax the MoD performance criterion from 0.40 to 0.55 m and the DoM criterion from 0.20 to 0.25 m.
- Yaw Damping Coefficient (YDC). The simulation for YDC must be conducted at 100 km/h. This is distinct from the Australian PBS Assessment Rules in which the vehicle's "certified speed" is used.
- Car-carrier combinations: A PBS car-carrier that meets the Level 2 (but not Level 3 or 4) criteria for Startability and Gradeability A will be approved as a Level 1 car-carrier. However, such PBS car-carriers must at all times comply with Regulation 239 (3) of the National Road Traffic Regulations, which limits the maximum combination mass to 5 times the actual mass on the drive axle or axle unit. For motivation of this policy, see De Saxe *et al.* (2019) under References.

It should be noted that the payload density or specific gravity (SG) of a proposed PBS combination has a critical influence on the results of the safety assessment. For bulk commodities, the commodity and associated SG must be clearly specified, along with the source of this data and the methodology used to determine centre of gravity heights. Where multiple commodities are to be transported by the combination, the worst loading case considered must be identified and described. If the worst-performing loading case is not easily evident, all variants must be assessed, and performance reported.

As per the Australian PBS rules, a vehicle must pass ALL performance standards in accordance with the level of road access being sought. The overall road access level achieved is determined by the worst performing standard. No standard may be failed for any PBS applications.

#### 2.4 Smart Truck design approval (See Annexure F)

The PBS safety assessment and bridge & road wear assessment reports, together with at least one concept approval letter (unless a truck or trailer manufacturer are applying for approval to market a design as detailed in Section 2.2) must be submitted to the Smart Truck Review Panel for approval. The Review Panel may at its discretion invite one or more representatives of the applicant to attend a Review Panel meeting. Should the Review Panel not be entirely satisfied with the application, further information may be required from the applicant.

## 2.5 Vehicle manufacture

On receipt of the final operational approval, the applicant may proceed with the manufacture and purchase of the vehicle components in accordance with the approved design.

## 2.6 NaTIS registration

NaTIS registration and vehicle licensing processes should be followed once the vehicle combination is ready for operation.

## 2.7 Commissioning

Once the vehicle has been registered and licensed, a PBS vehicle commissioner accredited by the South African Smart Truck Review Panel will be required to verify the vehicle dimensions and other design feature and requirements such as the motorised unit make and model, tyre sizes, abnormal load boards and warning lights in accordance with the approved PBS design.

Commissioning is an important process to ensure that PBS vehicles are compliant with the relevant National Road Traffic Regulations and the applicable PBS safety assessment. Before commissioning is conducted by an accredited commissioner, a pre-commissioning checklist must be completed by the transport operator or representative (e.g. trailer manufacturer or OEM). The completed checklist must be sent to the vehicle commissioner, who will review the checklist to ensure that the vehicle is compliant before conducting the final commissioning of the PBS vehicles. The checklist for B-double vehicle combinations is provided in Annexure G. The completed and signed checklist shall be attached to the commissioning report compiled by the accredited PBS commissioner. Commissioning templates are provided in Annexure H. Additional commissioning templates will be developed from time to time to suit various PBS vehicle configurations.

## 2.8 Operation

On successful commissioning of the vehicle combination, an Abnormal Load period permit will be issued by the relevant A/L Permit Office(s) for a maximum period of twelve (12) months. The period permit will be renewed annually subject to adequate compliance of the Smart Truck to the permit conditions.

## 2.9 Monitoring

Operational data as specified in Section 6 is required to be submitted to the relevant Abnormal Load Permit Office(s) as well as the CSIR on a monthly basis in order to monitor compliance as well as to evaluate the benefits of the Smart Truck research programme demonstration projects. Live Satellite tracking links must be provided to Provincial or National Administration Staff on request.

<b>Activity</b>	<b>Responsible person/group</b>
1. RTMS certification	Operator/RTMS auditor
2. Concept design, proposed route(s)	Various (consignor, operator, manufacturer)
3. PBS application for concept approval	Transport operator/consignor/

(including routes) and principle approval (if required)	consignee
4. PBS concept approval	Relevant A/L permit offices
5. PBS principle approval (if required)	National DoT
6. Detail design	Trailer manufacturer/OEM
7. PBS assessments (infrastructure & safety)	Accredited PBS assessor (CSIR/Wits/Australia)
8. PBS design approval	Smart Truck Review Panel
9. Manufacture	Trailer manufacturer
10. NaTIS registration	SABS/NRCS/DoT
11. Commissioning	Certifier (road authority/CSIR)
12. Operation and monitoring (see Sections 4 and 7)	A/L Permit Office, auditor, CSIR

### 3 Vehicle design

The following features are required to be included in the vehicle design:

- ABS and/or EBS braking systems
- Retarders/intarders
- Side marker lights (truck/truck tractor and trailers)
- Xenon or LED headlights
- Amber flashing strobe light (at least 900 mm in width) on the roof of the truck/truck tractor
- Abnormal load signs front & back (text size 200 mm as per TRH11, Section 4). If the PBS combination length exceeds 22 m, the overall length must also be indicated on the board at the rear of the combination e.g. "ABNORMAL LENGTH VEHICLE – 27.4M"
- Smart Truck and RTMS boards on the front of the motorised unit. The Smart Truck board specifications are provided in Annexure C.
- Name of the operator must be clearly displayed on the doors of the motorised unit (as a minimum).
- Vehicle management system (for monitoring driver performance including speeding, harsh braking/acceleration, vehicle location)

The following features are available on some models of heavy vehicles and are recommended. One or more may become a requirement in the future.

- Rollover prevention system (ESC/ESP)
- Adaptive Cruise Control (Active distance control)
- Lane departure warning system
- Driver fatigue warning devices
- Tyre pressure monitoring and control
- Driver CAM

**Nudge bars** (bull bars). Nudge bars may be fitted, in some cases to meet the PBS Maximum of Difference (MoD) requirement. However, nudge bars may not extend beyond the outer edge of the front steer axle tyres.

## 4 Operation

- Vehicle combination to be under the manufacturer's warranty at the time of the commissioning of the Smart Truck i.e. all vehicle components must be relatively new.
- Transfer of ownership. In cases where a transport operator purchases PBS vehicles from another operator, upon applying for a PBS permit, the transport operator must provide:
  - evidence of the full-service history of the truck/truck tractor and trailer(s)
  - a full Dekra technical inspection report
- Route classification – Route assessments are required to be done by a competent person (such as the driver trainer, Depot or SHEQ Manager) at regular intervals (at least bi-monthly) in order to monitor risk.
- Operation of Smart Trucks only on pre-defined and approved routes
- Display of Abnormal boards. In the case of PBS vehicles that do not exceed the permissible maximum combination length (of 18.5 or 22 m), such vehicles may operate as standard legal vehicles in terms of the NRTR mass limits on non-approved routes. In such cases both Abnormal boards MUST either be removed or reversed.
- Vehicle tracking information to be provided to the DoT at least on a monthly basis (see Section 7)
- Speed restrictions: 80 km/hr but lower speed limits may be specified under the permit conditions for larger PBS vehicles at the discretion of the issuing authority.
- Headlights on when vehicle is in operation
- Amber flashing strobe light on cab to be operational at all times.
- Following distance (between Smart Trucks): The driver must keep a minimum following distance of 100 m between consecutive Smart Trucks. Normal following distance requirements apply to all other vehicles.
- Vehicle maintenance requirements – tyres, suspension and brakes. Records to be kept of maintenance in terms of component manufacturer's requirements (RTMS requirement)
- Mass tolerance (0% on combination mass; 2% on axles and axle units)

## 5 Maintenance and service rules

The RTMS standard, SANS 1395:2019 (or SANS 1395:2014), has specific requirements regarding the servicing and maintenance of all vehicles that are part of an RTMS-certified fleet. See Section 4.2.4 of the standard.

All PBS trucks, truck tractors and trailers must be serviced in accordance with the manufacturer's/ OEM's service requirements. Truck/truck tractor service intervals will be specified by the OEM depending on the nature of the transport operation e.g. mining, forestry, fuel, long haul, short haul. Service intervals can thus vary from as little as 20 000 kms to as much as 70 000 or 80 000 kms. Some trucks now have intelligent servicing systems, so the recommended service interval will vary during the life of the vehicle.

Service intervals for trailers will also vary depending on the nature of the operation e.g. 30 to 60 days for long haul operations and up to 3 months for short haul operations. Advice from the

trailer manufactures should be observed in terms of the specific transport application. The structural integrity of trailers (including the chassis and side-tipper bins) should be maintained at all times.

## 6 Drivers

The following issues are considered important in terms of drivers of Smart Trucks:

- Driver age shall be limited to between 25 and 60 (as in the case of dangerous goods driver requirements)
- experience within the company and a minimum of five years traceable heavy goods vehicle driving experience. The same applies to drivers of PBS buses. Deviation from the requirement for a minimum of one year with the company will be considered by Review Panel based on motivation from the operator e.g. PBS drivers that have moved from another company.
- Driver testing  
The recommended tests and frequency that should be considered when formulating a driver testing programme are provided in Annexure D and are derived from the South African Association of Occupational Medicine (SASOM) “Guidelines for Driver Requirements for Fitness to Drive” (SASOM, 2017)
- Driver screening  
Guidelines for driver screening are provided in Annexure D. Note that screening should include psychometric tests to evaluate the driver’s ability to deal with anxiety and anger.
- Driver hours are in accordance with the government requirements (Govt. Gazette No. 38142, 31 Oct 2014) and the NBCFRI Main Collective Agreement (Govt. Gazette No. 40385, 28 Oct 2016)
- Driver training - Evidence of frequent driver refresher training is required i.e. at least every six months in order to minimise complacency.
- Driver training courses must include the following topics:
  - Differences in driving a standard heavy vehicle and a PBS vehicle
  - PBS permits: understanding the purpose and requirements
  - Dimensions: what is and is not allowed and the effects of increased dimensions
  - PBS routes: why routes are specified and why no deviations are allowed
  - Increased combination mass: how it affects vehicle handling etc.
  - Impact of PBS vehicles on other road users, congestion and road furniture
- Fatigue warning
  - “Graveyard” shifts (Between 00h00 and 06h00) should be monitored very closely. Controllers should make contact with drivers on this shift at regular intervals and these checks must be logged.
- Driver wellness  
PBS drivers should be part of a recognised occupational health programme, conducted by competent accredited persons, which should be in line with the SASOM “Guidelines for Driver Requirements for Fitness to Drive” (SASOM, 2017) and should include, but not be limited to:
  - Bi-annual medicals as per the SASOM Guidelines.

- A six-monthly programme that includes:
  1. Monitoring and control for hypertensive employees;
  2. Monitoring and control for diabetic employees;
  3. Monitoring for chronic or relapsing disorders that may impair cognitive or executive motor function;
  4. Screening for pulmonary tuberculosis;
  5. Fatigue management;
  6. Drug and alcohol screening that complies with current legal protocols;
  7. Return to work reassessment for drivers having been absent for longer than 5 days;
  8. Programme for medical reassessment immediately or soon after any incident.

## **7 Crashes involving PBS vehicles**

In the case of a crash involving a PBS vehicle, the following procedure must be followed:

1. The operator must inform the provincial road authority (Permit Office) both verbally and by e-mail within 24 hours of the occurrence,
2. A preliminary written report must be submitted to the province within 72 hours.
3. A final report must be completed and submitted to the province within 7 days.
4. A copy of the final report must be included with the monthly Smart Truck monitoring report recording any fatalities.

## **8 Data and monitoring**

The following data are required to be submitted to the DoT on a monthly basis for all PBS vehicles and an agreed sample of baseline vehicles:

- Combination mass per trip
- Speed profile including average speed per month
- Routes travelled (vehicle tracking system output)
- No. of trips per month per vehicle
- Tons transported per month per vehicle
- Average payload per month per vehicle
- Total and average fuel consumption per month per vehicle
- Total distance travelled per month per vehicle
- Record of incidents/crashes (RTMS requirement)
- Driver hours (RTMS requirement)
- Driver performance – reports must be generated from the vehicle management system.

PBS monitoring data will be used for research purposes, and may be published in anonymised form, for example in technical reports, presentations, conference papers and journal papers.

## **9 Administrative rules**

The classification of offences and sanctions are given in Annexure B.

## **10 General arrangement (GA) drawings**

Requirements for GA drawings, which must be included in PBS safety assessment reports, are specified in Annexure E.

## REFERENCES

De Saxe, CC, Kemp, L & Nordengen, PA. 2019. Gradeability and Startability performance of PBS car-carrier truck combinations in South Africa, CSIR.

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DoT. 2013. National Road Traffic Regulations No. R.225 of 2000 (as amended up to the National Road Traffic Amendment Act, No. 64 of 2008 and Government Gazette 36862, 2013). National Department of Transport, South Africa.

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**ANNEXURE A****Detailed guidelines for the operation of Smart Trucks as part of the Smart Truck Demonstration project: Applications for Concept Approval**

1. The letter of application should clearly state that the operator wishes to participate in the Smart Truck demonstration project that is being co-ordinated by the National Department of Transport's Smart Truck Review Panel and Provincial Road Authorities supported by the CSIR.
2. The operator must be certified in terms of the Road Transport Management System (RTMS) accreditation scheme. The fleet in which the proposed Smart Truck will operate must have been RTMS-certified for a minimum of six months at the time of commissioning of the Smart Truck(s). A copy of the current RTMS certificate must be submitted with the application OR a confirmation that the RTMS-certification process has commenced and that the commissioning of the proposed Smart Trucks will only take place after the depot has been RTMS-certified i.e. has met the requirements of the RTMS standard through an audit for a minimum period of six months.
3. The application letter must specify the make and model of the truck/truck tractor. More than one make/model truck/truck tractor may be specified. The trailer manufacturer must also be specified.
4. The application letter must specify the number of Smart Truck vehicle combinations the operator wishes utilise on the specified route(s).
5. The application letter must include a summary of the vehicle combination masses and dimensions, e.g. maximum overall length, width and height, maximum combination mass and payload and clearly indicate the National Road Traffic Act (NRTA) Regulations with which the proposed vehicle combination does not comply.
6. The application letter must specify with which PBS Level (1, 2, 3 or 4) the proposed Smart Truck design intends to comply. Level 1 will generally be required for multiple routes. Level 2 is applicable to major freight routes. Levels 3 and 4 are generally reserved for remote routes with suitable road geometry i.e. roads with low traffic volumes, flat gradients and large horizontal curvatures.
7. A general arrangement drawing of the proposed Smart Truck must accompany the letter requesting operational approval. The drawing must clearly indicate all key dimensions (such as total vehicle combination length and dimensions between axle centres) as well as laden and unladen (tare) axle masses, the maximum combination mass and maximum payload. Maximum axle and axle unit masses may not exceed the permissible maximum axle and axle unit masses as specified in the NRTA Regulations. The maximum combination mass applied for must *include* any tolerance required for the specific payload i.e. no additional mass tolerance above the approved maximum combination mass will be allowed at law enforcement weighbridges.

8. A detailed description of the route(s), including a detailed map, on which the proposed Smart Truck will operate, must also be attached to the letter of application. One or more of the proposed route(s) may be rejected by the Department depending on factors such as route geometry and traffic volumes.
9. The applicant may choose to submit preliminary PBS infrastructure and safety assessments together with the letter of application for concept approval, but these assessments are only required to be done after Concept Approval has been obtained and will need to be submitted to the Smart Truck Review Panel for review. The assessment must show that the proposed Smart Truck passes the heavy vehicle safety analysis and must be shown to cause less road wear per ton of payload than the “baseline” vehicle combination that is currently operational. The baseline vehicle must be a realistically efficient legal vehicle combination for the freight task in question. The calculation methodology for the road wear assessment must be based on the Mechanical-Empirical assessment approach that is the basis for the new SA Pavement Design Manual.
10. If a PBS Level 2, 3 or 4 proposed Smart Truck does not comply with the “legal” bridge formula, an Abnormal Load Bridge Formula (ALBF) assessment must also accompany the application. The ALBF assessment should ensure a minimum factor of safety of 30% for the proposed Smart Truck unless the route on which the Smart Truck(s) will operate either have no structures or the structure are limited such that a more detailed assessment can be done based on actual bridge and culvert span lengths and/or actual bridge design loads e.g. TMH7 NC loading. In terms of the revised (first principle) approach for assessing structures, the Bending Moment Factor may not exceed 0.85 and the Shear Force Factor may not exceed 0.85. Should either of these factors be exceeded, a more detailed assessment (route clearance) will be required. Level 1 (General Accessibility) Smart Trucks must comply with Regulation 241 of the NRTA, the “legal” bridge formula.
11. An important principle of the Performance-Based Standards approach to heavy vehicle design and operation is that an overall improvement in terms of criteria such as road wear, truck safety performance, congestion, number of truck trips, fuel efficiency and emissions is achieved. This balanced approach will result in benefits to all affected parties i.e. the consignor, the consignee, the transport operator, the road authority and other road users. Thus, the vehicle design must not only address the needs of the transport operator but must actively seek to improve the situation from the Road Authority’s perspective.

**ANNEXURE B****CLASSIFICATION OF OFFENCES REGARDING THE OPERATION OF SMART TRUCKS  
AND THE APPROPRIATE SANCTIONS TO BE IMPOSED FOR SUCH ACTIONS****CLASS A OFFENCE****Un-Authorized Modification of a Smart Truck**

Any change in the parameters of the physical PBS vehicle as specified in the approved design of the PBS vehicle.

**Off-Route Operation of a PBS Vehicle**

A Smart Truck may not operate on any routes other than those specified in the Section 81 Exemption Permit. In the event of a vehicle deviating from the approved route due to unforeseen circumstances such as a crash, the operator must report such to the relevant Permit Office in the form of a signed affidavit, witnessed by a commissioner of oaths by no later than 13:00 on the next working day of the Permit Office.

**RTMS-certification**

Suspension of RTMS-certification

**SANCTION**

Immediate withdrawal of the Section 81 Permit

**CLASS B OFFENCE****Overloading**

Overloading of axle groups and combination mass as specified on the Section 81 Permit. A 2% tolerance on axles and axle units will be permitted subject to the 2% not exceeding the manufacturers rating for the axle/axle unit. There will be no tolerance permitted on the combination mass for vehicles operating under Section 81 Exemption Permit.

**Speed**

All Smart Trucks must operate at the speed limits specified on the Section 81 Exemption Permit or at a lower speed where the route is signposted as such.

**SANCTION**

A written warning will be sent to the operator on the offence. Three such letters in a six-month period will result in the withdrawal of the Section 81 Exemption Permit.

## **CLASS C OFFENCE**

### **Refusal to supply information pertaining to a Smart Truck.**

All information pertaining to any Smart Truck requested by the Administration must be supplied by the operator within 10 calendar days of a written or verbal request.

### **Non Compliance of Section 81 Permit Conditions**

The permit conditions as contained in the Section 81 Exemption Permit must be complied with at all times.

## **SANCTION**

A written warning will be sent to the operator regarding the offence. Four letters of this nature in a six-month period will result in the withdrawal of the Section 81 Exemption Permit.

## **VEHICLE MONITORING BY MEANS OF SATELLITE TRACKING**

All operators of Smart Trucks are required to submit to the Permit Office records of satellite tracking for each Smart Truck by no later than the 5<sup>th</sup> day of the month after the reporting month.

The records must depict the following:

- Period of validity e.g. 01 January 2021 to 31 January 2021
- Smart Truck Registration Numbers
- Detailed map depicting all trips thereon. The map must be of a suitable size and scale
- Average Payload per Smart Truck
- Actual combination mass of each Smart Truck for all trips
- Average combination mass per Smart Truck
- Any exceptions to the operating requirements as outlined on the Section 81 Exemption Permits in terms of speed, route and combination mass

These records will be pertinent for each Smart Truck and as such each combination will require a report.

**ANNEXURE C**

**SPECIFICATIONS FOR SMART TRUCK BOARD**



**Blue**

C 84  
M 62  
Y 0  
K 0

**Yellow Grey**

C 7            C 27  
M 4            M 21  
Y 93          Y 21  
K 0            K 0

## ANNEXURE D

### STRUCTURE OF A DRIVER TESTING PROGRAMME

The following tests and frequency should be considered when formulating a driver testing programme. See “SASOM Guidelines for Driver Requirements for Fitness to Drive” for suggested “routine” minimum medical standards.

#### Test Selection

- Interview:
  - Seek out chronic disorders as listed in the section “Criteria for Fitness to Drive”. Record date of diagnosis, medication and any hospitalisation or complications.
  - Screen for signs of fatigue, and risk factors for becoming fatigued.
- Examination: (areas of particular interest)
  - Sensory functions (vision, hearing & proprioception)
  - Neuro-musculoskeletal (mobility, coordination, motor control)
  - CNS (clarity of thought), including:
    - Chronic or relapsing disorders that may impair cognitive or executive motor function (cardiovascular, endocrine, neurological, infection (notably HIV), substances)
    - Risk of sleep apnoea (with daytime somnolence)
- Special tests:
  - Vision tests (NB: refer to the SASOM vision standard)
    - Mandatory: **Visual Acuity** (far & near); **peripheral vision**; **colour** (primary colours).
    - As applicable to the setting, and within the guidelines of the Vision Standard: depth perception, “night” vision.
  - Additional tests where clinically indicated:
    - Diabetics should all have a random blood glucose and HBA1c.
    - Cardiac issues may require an ECG (e.g. abnormal dysrhythmia, severe hypertension, ischaemic heart disease).
  - Tests for substance abuse: (should be used in tandem with a substance abuse policy)
    - alcohol (blood **GGT**; if elevated and alcohol suspected, proceed to **CDT**)
    - drugs of abuse, including:
      - Minimum **core 5-panel: cannabis, opiates** (includes codeine, morphine, heroine), **amphetamines** (includes methamphetamines (“TIK”) & methcathinone (CAT)), **cocaine, benzodiazepines**.
      - Also consider: **MDMA** (“Ecstasy”)
        - Note: Mandrax (methaqualone) is not screened for, because it is always used in combination with cannabis, so users will be identified through a positive THC test.
  - Where there is exposure to hazards, appropriate surveillance testing must be included: e.g. audiometry, spirometry, FBC (chemicals), AST, ALT (chemicals).
  - Psychometric tests: to evaluate the driver’s ability to deal with anxiety and anger

## General Overview

<u>At Pre-placement</u>	<u>At Periodic Assessments</u>	<u>At Exit</u>
<ul style="list-style-type: none"> <li>• Interview, clinical exam (see above)</li> <li>• Vision tests (as above)</li> <li>• Fatigue questionnaires</li> <li>• GGT (CDT if indicated)</li> <li>• Urine for substance abuse (see above)</li> <li>• Surveillance tests, as indicated by job exposures (audio, PFT, FBC) – as baselines.</li> <li>• If indicated by clinical findings: (PFT, ECG).</li> </ul>	<ul style="list-style-type: none"> <li>• As for pre-placement</li> <li>• Surveillance tests, as indicated by job exposures (audio, PFT, FBC).</li> </ul>	<ul style="list-style-type: none"> <li>• Interview, brief clinical exam</li> <li>• Surveillance tests, as indicated by job exposures (audio, PFT, FBC).</li> </ul>
	<p style="text-align: center;"><b><u>Test Frequency</u></b></p> <ul style="list-style-type: none"> <li>• Standard interval is annual, but may be sooner if indicated. For healthy drivers &lt;45 years old, every 2 years)</li> <li>• PrDP maximum legal interval is 24mnths</li> <li>• Surveillance intervals as indicated by the appropriate legislation</li> </ul>	

### General points:

1. It is important that written informed consent must be obtained. See the SASOM standard for informed consent.
2. When a driver is examined for the first time by a health professional more time should be allocated to history taking and the gathering of relevant information.
3. The health professional performing the evaluation must have discretion in each case to include or exclude any of the actions prescribed in the protocol.
4. Where an established on-site occupational health service is not in operation, it is advisable to make use of the same health professional/practice to maintain continuity.
5. Ensure the levels of competency of the health professionals involved in the testing are appropriate to the risks, and that the registration of the certifying professional is compliant with the legal requirement.
6. It is recommended that a “return to work evaluation” be conducted after significant ill health absence (e.g. >10 days), especially for category 2 & 3 drivers.

### Acronyms:

Acronym	Complete Term	Brief description
GGT	Gamma Glutamyl Transpeptidase	A liver enzyme that is elevated in when certain hepatic metabolic processes are stimulated, such as in cases of long term excessive alcohol consumption. However, it is elevated in a variety of circumstances, so should only be used as a screening tool; further testing should be done (e.g. CDT), to confirm a link with alcohol consumption.
CDT	Carbohydrate-Deficient Transferrin	A serum protein that is elevated in excessive alcohol consumption. Also may be elevated in the following circumstances: <ul style="list-style-type: none"> <li>• Rare genetic variants of transferrin (&lt;1%)</li> <li>• Rare inborn error of glycoprotein metabolism</li> <li>• Severe hepatic insufficiency</li> <li>• Pregnancy (especially after the first 10 weeks of pregnancy)</li> </ul> <p>It has been established that occasional ‘binge’ drinking does not increase serum CDT levels. Regular heavy drinking is required to elevate levels significantly. Sensitivity of the test for males is then 93% and the specificity 98%. For females, sensitivity is 81% and the specificity remains at 98%.</p>
HBA1c	Glycated (glycosylated) haemoglobin	A form of haemoglobin that represents the average plasma glucose levels for the preceding 3 months.

FBC	Full Blood Count	A laboratory test in which a variety of haematological parameters are measured including:
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## ANNEXURE E

### GUIDELINES FOR GENERAL ARRANGEMENT (GA) DRAWINGS

The GA drawings for PBS combinations have the following requirements regarding dimensions and specifications in order to conduct performance and safety assessments:

The datum for all dimensions should be taken from the vehicle centreline at either (datums shown in blue):

1. **Lead unit:** steer axle at ground level
2. **Trailer unit:** hitch position at ground level

The loading condition at which the dimensions are provided must be indicated on the GA drawing

The following dimensions must be present on all GA drawings or supplied in supplementary documents:

#### **Geometric**

- furthest forward or outside point, or points, on both sides of each vehicle unit
- furthest rearward or outside point, or points, on both sides of each vehicle unit
- should there be a payload projection, provide the furthest forward or outside point or points for both the laden and unladen condition (no payload projection – trailer structure only)
- should there be ambiguity as to which point is the furthest forward or outside point, please provide dimensions for all possibilities
- location of all axles with a dimension showing axle spacing for axle groups
- all axle track widths must be indicated in the plan view
- location of the hitch (including height from the ground)
- maximum combination width and height
- overall combination length including any ancillary equipment
- a clear distinction between the hitch location and wheelbase must be made

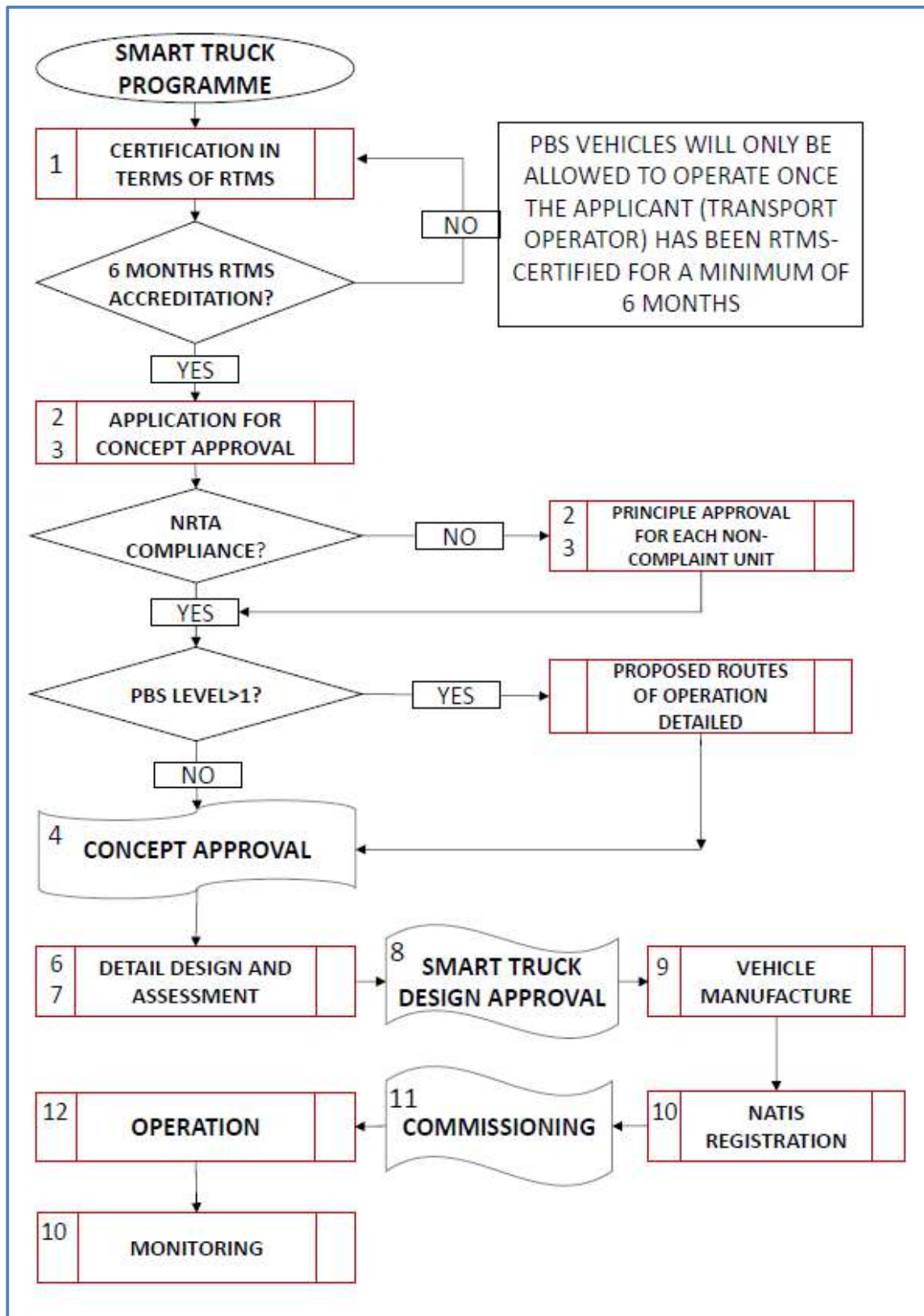
**Inertial** (can be supplied in supporting documentation for clarity)

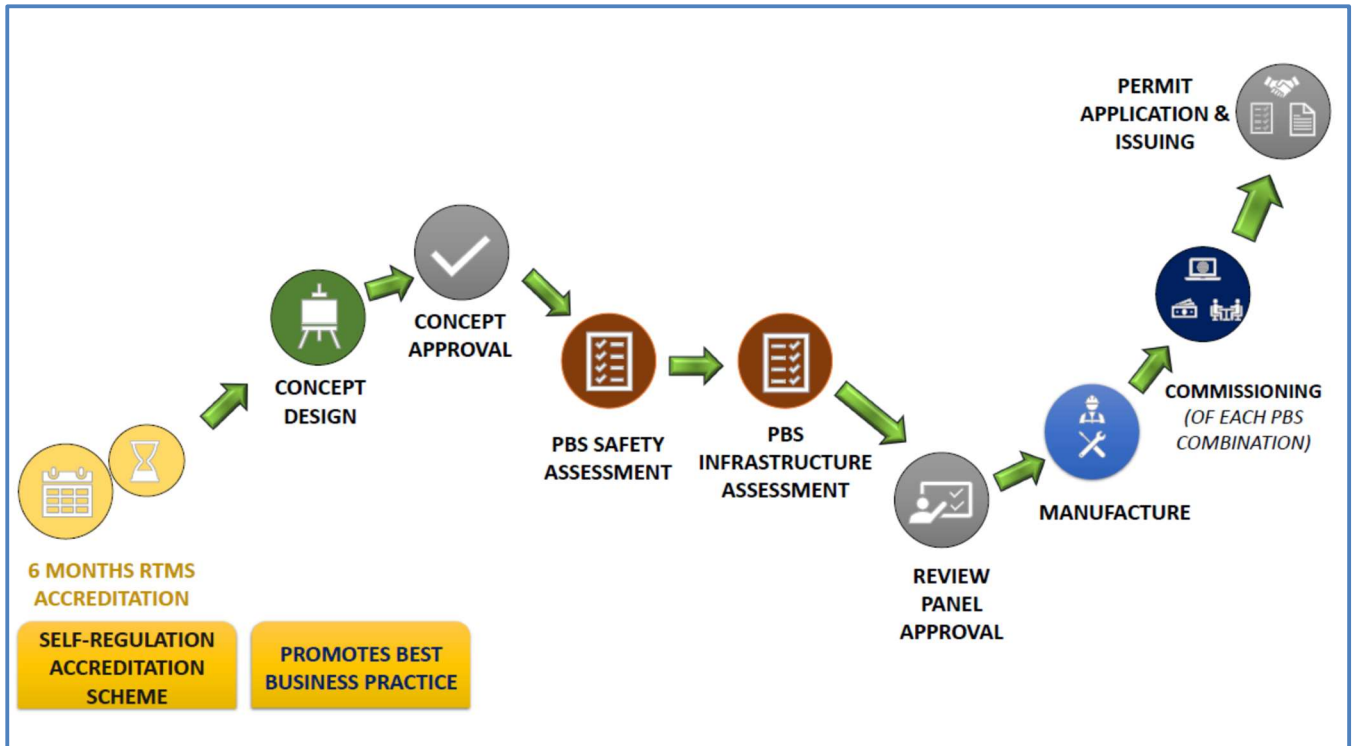
- the position of the payload centre of gravity relative to the steer axle or hitch for following units
- the position of the sprung mass centre of gravity for all vehicle units
- Axle loads in the laden condition

#### **Car carrier specifics**

- The geometry of the payload for a car carrier is assumed as a 2 000 mm wide vehicle with 350 mm radius corners, the assessment should include the reference point on the 350 mm radius at an angle of 30° to the horizontal (i.e. at a width of 953 mm from the vehicle centreline)

## Annexure F – PBS project implementation process





## Annexure G – PBS Vehicle Commissioning Checklist for Transport Operators

### (B-double)

Vehicle unit	Parameter to be checked	Value obtained by Operator/OEM	Additional comments
Prime mover	Prime mover VIN		
	Abnormal load board fitted with 200mm lettering?		
	RTMS and Smart Truck boards fitted?		
	900mm amber strobe light fitted?		
	Load cells fitted or planned to be fitted?		
	GCM on the VIN plate of the vehicle?		
	Rim material used		
	On which axles are stabilizers fitted? (specify model)		
	Tyre size on steer axle(s)		
	Tyre size on drive axle (s)		
	Suspension model on steer axle(s)		
	Suspension model on drive axle(s)		
	Front overhang from steer axle		
	Overall length of combination		
	Fifth wheel offset from centre of drive axle group		
Fifth wheel height from floor			
Leader Trailer	Leader Trailer VIN		
	Tyre size on leader trailer		
	Fifth wheel height on leader trailer		
	Fifth wheel offset from centre of axle group		
	Suspension model on leader trailer		
	Maximum trailer height at front of trailer (bin lip)		
	Maximum chassis height at rear of trailer (bin lip)		
	Wheelbase (fifth wheel to centre of trailer axle group)		
	Rim material used		
	Maximum loading height indicated? (if applicable)		

Follower Trailer	Follower Trailer VIN		
	Tyre size on follower trailer		
	Suspension model on follower trailer		
	Maximum trailer height at front of trailer (bin lip)		
	Maximum chassis height at rear of trailer (bin lip)		
	Wheelbase (fifth wheel to centre of trailer axle group)		
	Rear overhang from centre of last axle		
	Rim material used		
	Abnormal load board fitted with 200mm lettering?		
	Maximum loading height indicated? (if applicable)		

## ANNEXURE H

### TEMPLATES FOR PBS VEHICLE COMMISSIONING

<b>Full description of combination:</b>	<i>(Example: Volvo FH 64 T3HA 520 6x4 in 40-Pallet A-Double Combination with Steerable Trailer Axles)</i>		
<b>Date:</b>	<b>Assessor details</b>		
<b>Operator:</b>			
<b>Truck make and model:</b> <i>(Example: Volvo FH 64 T3HA 520)</i>			
<b>Trailer manufacturer:</b> <i>(Example: Afrit)</i>			
<b>GCM:</b> <i>(Example: 82 130 kg)</i>	Name:		
	Affiliation:		

#### Overall Vehicle Parameters

Parameter		VIN # →	
		Required value	Measured values
Prime mover model		Volvo FH 64 T3HA 520	
Overall Length	mm	29 999	
"Abnormal vehicle" signage	✓/✗	✓	
Amber lights	✓/✗	✓	
Marker lights and reflectors	✓/✗	✓	
RTMS board	✓/✗	✓	
PBS board	✓/✗	✓	
EBS/ABS	✓/✗	✓	
Load cells	✓/✗	✓	
		Accepted? (✓/✗)	

<b>Full description of combination:</b>	<i>(Example: Volvo FH 64 T3HA 520 6x4 in 40-Pallet A-Double Combination with Steerable Trailer Axles)</i>		
<b>Date:</b>			
<b>Operator:</b>			
<b>Truck make and model:</b>	<i>(Example: Volvo FH 64 T3HA 520)</i>		
<b>Trailer manufacturer:</b>	<i>(Example: Afrit)</i>		
<b>GCM:</b>	<i>(Example: 82 130 kg)</i>		
		<b>Assessor details</b>	
		Name:	
		Affiliation:	

## Unit Parameters

		Registration Plate Number	# axles	Front overhang (max) (mm)	Rear overhang (mm)	Hitch offset (from 1st axle or previous hitch) (mm)	Maximum width (mm)	Maximum height (mm)	
<b>Unit 1</b>	req.								Accepted? (✓/✗)
	meas.								
<b>Unit 2</b>	req.								Accepted? (✓/✗)
	meas.								
<b>Unit 3</b>	req.								Accepted? (✓/✗)
	meas.								
<b>Unit 4</b>	req.								Accepted? (✓/✗)
	meas.								
<b>Unit 5</b>	req.								Accepted? (✓/✗)
	meas.								

<b>Full description of combination:</b>	<i>Example: Volvo FH 64 T3HA 520 6x4 in 40-Pallet A-Double Combination with Steerable Trailer Axles</i>	
<b>Date:</b>	<b>Assessor details</b>	
<b>Operator:</b>	Name:	
<b>Truck make and model:</b> <i>Example: Volvo FH 64 T3HA 520</i>	Affiliation:	
<b>Trailer manufacturer:</b> <i>Example: Afrit</i>		
<b>GCM:</b> <i>Example: 82 130 kg</i>		

#### Axle Parameters

		Distance to axle (from first axle or hitch)	Tyre size - Steer axles	Stabilizer	Single/Dual tyres	Type of suspension (steel/air)	Width between outer tyre walls	Steering (none, self, active)	Driven	
		mm			F/R	F/R	mm		y/n	
<b>Axle 1</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 2</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 3</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 4</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 5</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 6</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 7</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 8</b>	req.									Accepted? (✓/✗)

	meas.									
<b>Axle 9</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 10</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 11</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 12</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 13</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 14</b>	req.									Accepted? (✓/✗)
	meas.									
<b>Axle 15</b>	req.									Accepted? (✓/✗)
	meas.									