LDP FUNCTION SPECIFICATION
LDP 功能描述

Contents

History

Date	Author	Description	Version
20/11/2019	Zhongyan Bi	Initial	1.0

Abbreviations

Abbreviations	Description
ABS	Anti-lock Braking System
ESP	Electrical Stability Program
EPS	Electrical Power Steering
LDP	Lane Departure Protection
TCS	Traction Control System
TSA	Trailer Stability Assist

1 Function Requirements 功能要求

1.1 Function Description 功能介绍

The LDP function assists the driver in an unwanted leaving of the ego lane. If the driver gets closer to the lane marking without turning on the indicator in the corresponding direction, the LDP function supports the driver with a steering intervention, keeping the vehicle in the lane and performing a parallel lane alignment. The warning cascade can be enriched by Lane Departure Warning (LDP) function via a visual, haptic or audible feedback.

LDP 功能在无意识道路偏离时，辅助驾驶员纠正车辆。当车辆的一侧转向灯未开启，且正在往此方向偏离时，LDP 功能会通过转向介入，将车辆保持在车道内，并且使车辆与车道线平行。该功能还可与 LDP 报警功能结合使用。

1.2 Function Conditions 状态迁移条件

1.2.1 Function Activation Condition 功能激活条件

Function Activation means that the function can be activated (switched on) so that it is available in principle for triggering a lateral intervention.
功能开启意味着功能能够被激活，且提供横向介入。
The LDP function **Activation Condition** shall be fulfilled and the function shall become activated or shall stay activated, if **ALL** of the following conditions are fulfilled:
若以下所有条件满足，则满足 LDP 功能的激活条件，且功能保持在激活状态:

1. The LDP function is coded.
   功能已被配置
2. The LDP function is switched ON.
   功能由驾驶员打开

1.2.2 Function De-Activation Condition 功能未激活条件

Function De-Activation means that the function can NOT be activated or needs to be de-activated (switched off) so that the function is not allowed to trigger a lateral intervention.
功能未激活说明功能不能被激活，或关闭功能以禁止横向介入触发
The LDP function **De-Activation Condition** shall be fulfilled and the function shall become de-activated or shall stay de-activated, if **AT LEAST ONE** of the following conditions is fulfilled:
若满足以下任一条件，则功能未激活条件满足：

1. The LDP function is NOT coded.
   LDP 功能未被配置
2. The LDP function is NOT **switched** ON.
   功能未被打开

1.2.3 Function Availability Condition 功能可用条件

Function Availability means that the function is in principle available for triggering a lateral intervention. The Function Availability Condition is devided into side-independent and side-dependent (left/right) conditions.
功能可用说明功能满足横向介入的预先条件。功能可用条件分为与方向有关的和与方向无关的条件。
NOTE: Function Availability requires that the Function Activation Condition is fulfilled.
注意：功能可用要求功能激活条件满足

- If the Function Activation Condition is not fulfilled, the function can only be in function De-Activation state.
若功能激活条件不满足，则功能处于未激活状态

1.2.3.1 Side-Independent Availability Condition 与方向无关的可用条件

The LDP function **Side-Independent Availability Condition** shall be fulfilled and the function shall become available or stay available **side-independent**, if **ALL** of the following pre-conditions are fulfilled:

若满足以下所有条件，则与方向无关的可用条件满足

1. The function **Activation Condition** is fulfilled.
   功能激活条件满足
2. The ego-vehicle **speedometer velocity** is in the valid velocity range (**cLDP_VehicleSpeedMin_kph <= ego-vehicle speedometer velocity <= cLDP_VehicleSpeedMax_kph**).
   自车速度表速度在(**cLDP_VehicleSpeedMin_kph <= ego-vehicle speedometer velocity <= cLDP_VehicleSpeedMax_kph**)范围之内
   The condition shall also use a hysteresis, which requires the velocity to be equal/above (**cLDP_VehicleSpeedMin_kph** - **cLDP_VehicleSpeedMinHyst_kph**) and equal/below (**cLDP_VehicleSpeedMax_kph** + **cLDP_VehicleSpeedMaxHyst_kph**), if the velocity has been in the above valid velocity range before.
   若速度之前已在有效的速度范围内，则该条件考虑滞后，并要求速度满足大于等于 (**cLDP_VehicleSpeedMin_kph** - **cLDP_VehicleSpeedMinHyst_kph**)，且小于等于 **(cLDP_VehicleSpeedMax_kph + cLDP_VehicleSpeedMaxHyst_kph)**
3. If two lane markings are available, which describe the ego-vehicle lane, the ego-vehicle lane width shall be equal/above **cLDP_LaneWidthMinTrigger_met AND** equal/below **cLDP_LaneWidthMaxTrigger_met**.
   若存在两条代表自车车道的车道线，则该条车道的宽度需大于等于 **cLDP_LaneWidthMinTrigger_met** 且小于等于 **cLDP_LaneWidthMaxTrigger_met**

   If only one lane marking is available for a certain side (left/right), the condition shall be only fulfilled for the certain side.
   若仅有一条车道线，则该条件自动满足

NOTE: The ego-vehicle lane is described by the two lane markings, which:
注意：自车车道的车道线需满足：

- Are not located under the ego-vehicle. 不在自车车下
- Are the lane markings with smallest lateral distance to the ego-vehicle on each side (left/right) of the ego-vehicle. 离自车的横向距离最近
- Have lateral y-distance to the ego-vehicle lateral center not bigger than **cLDP_LaneWidthMaxTrigger_met + cLDP_LaneWidthHystTrigger_met**. 离自车横向中心的距离小于 **cLDP_LaneWidthMaxTrigger_met + cLDP_LaneWidthHystTrigger_met**

4. The ego-vehicle's **hazard lights** is NOT activated.
   警示灯未被激活
5. The ego-vehicle has NO **trailer** attached.
   自车没有与拖车连接
6. The ego-vehicle is **driving forward**.
   自车向前行驶
7. The ego-vehicle longitudinal acceleration is less than the threshold **cLDP_VehLongAccelerationThTrigger_mpss**.
   自车的纵向加速度小于 **cLDP_VehLongAccelerationThTrigger_mpss**.
8. The ego-vehicle longitudinal decceleration is less than the threshold **cLDP_VehLongDecelerationThTrigger_mpss**.
   自车的纵向减速度小于 **cLDP_VehLongDecelerationThTrigger_mpss**
9. The ego-vehicle **absolute lateral acceleration** is less than the threshold **cLDP_VehLatAccelerationThTrigger_mpss**.
   自车的横向加速的绝对值小于 **cLDP_VehLatAccelerationThTrigger_mpss**.
10. The **ABS** function is NOT deactivated and is available.
    ABS 激活且可用
11. The **ABS** function is NOT performing an intervention.
    ABS 没有进行干预
12. The **ESC** function is NOT deactivated and is available.
    ESC 激活且可用
13. The **ESC** function is NOT performing an intervention.
    ESC 没有进行干预
14. The **TCS** function is NOT deactivated and is available.
    TCS 激活且可用
15. The **TCS** function is NOT performing an intervention.
    TCS 没有进行干预
16. The **TSA** function is NOT deactivated and is available.
    TSA 激活且可用
17. The **TSA** function is NOT performing an intervention.
    TSA 未介入
18. The Driver hands on.
    驾驶员未脱手

1.2.3.2 Side-Dependent Availability Condition 与方向有关的可用条件

The LDP function **Side-Dependent Availability Condition** shall be fulfilled and the function shall become available or stay available for a **certain side** (**left** or **right**), if **ALL** of the following pre-conditions are fulfilled:

若满足以下所有条件，则与方向有关的可用条件满足：

1. The **lane marking** is **available** on the **certain side** (left/right).
   某一边（左/右）存在可用的车道线
2. The **lane marking** on the certain side (left/right) is steady and does not show unsteady characteristics.
   若某一边（左/右）车道线稳定且未有不稳定的特性
3. The ego-vehicle **turn indicator** is NOT activated into the direction of the **certain side** (left/right).
   若某一边（左/右）转向灯未被激活
4. The ego-vehicle **absolute lateral approaching velocity** with regard to the available lane marking (left/right) on the **certain side** (left/right) is equal/below the threshold **cLDP_VelLatThresMax_mps**.
   自车在该方向上的横向速度需小于等于 **cLDP_VelLatThresMax_mps**..

1.2.4 Function Un-Availability Condition 功能不可用条件

Function Un-Availability means that the function is not available for a certain or both sides (left/right) for triggering a lateral intervention. The Function Un-Availability Condition is devided into side-independent and side-dependent (left/right) conditions.

功能不可用说明功能不能够提供横向介入。功能不可用条件分为与方向有关的和与方向无关的条件。

NOTE: Function Un-Availability requires that the function Activation Condition is fulfilled.

注意：功能不可用条件要求功能激活条件满足

- If the function Activation Condition is not fulfilled, the function can neither be in function Available or Un-Available state but only in function De-Activation state. 若未满足功能激活条件，则功能只可处于功能未激活状态

1.2.4.1 Side-Independent Un-Availability Condition 与方向无关的不可用条件

The LDP function **Side-Independent Un-Availability Condition** shall be fulfilled and the function shall become un-available or stay un-available **side-independent**, if **AT LEAST ONE** of the following conditions is fulfilled:

若满足以下任一条件，则与方向无关的不可用条件满足

1. The ego-vehicle **speedometer velocity** is not in the valid velocity range considering a hysteresis. This is the case, if the ego-vehicle velocity is below (**cLDP_VehicleSpeedMin_kph** - **cLDP_VehicleSpeedMinHyst_kph**) or above (**cLDP_VehicleSpeedMax_kph** + **cLDP_VehicleSpeedMaxHyst_kph**).

考虑滞后，自车的速度表车速小于**(cLDP_VehicleSpeedMin_kph - cLDP_VehicleSpeedMinHyst_kph)**，且大于**(cLDP_VehicleSpeedMax_kph + cLDP_VehicleSpeedMaxHyst_kph)**

2. The ego-vehicle's **hazard lights** is activated.
   警示灯被激活
3. The ego-vehicle is NOT **driving forward**.
   自车非向前行驶
4. The ego-vehicle has a **trailer** attached.
   自车连接着拖车
5. The ego-vehicle longitudinal acceleration is bigger than the threshold (**cLDP_VehLongAccelerationThTrigger_mpss** + **cLDP_VehLongAccelerationThHyst_mpss**).
   自车的纵向加速度大于阈值(**cLDP_VehLongAccelerationThTrigger_mpss** + **cLDP_VehLongAccelerationThHyst_mpss**)
6. The ego-vehicle longitudinal decceleration is bigger than the threshold (**cLDP_VehLongDecelerationThTrigger_mpss** + **cLDP_VehLongDecelerationThHyst_mpss**).
   自车的纵向减速度大于阈值(**cLDP_VehLongDecelerationThTrigger_mpss** + **cLDP_VehLongDecelerationThHyst_mpss)**
7. The ego-vehicle **absolute lateral acceleration** is bigger than the threshold (**cLDP_VehLatAccelerationThTrigger_mpss** + **cLDP_VehLatAccelerationThTriggerHyst_mpss**). 自车的横向加速度的绝对值大于阈值 (**cLDP_VehLatAccelerationThTrigger_mpss** + **cLDP_VehLatAccelerationThTriggerHyst_mpss)**
8. The **ABS** function is deactivated or is NOT available.
   ABS 未激活且不可用
9. The **ABS** function is performing an intervention.
   ABS 正在进行干预
10. The **ESC** function is deactivated or is NOT available.
    ESC 未激活且不可用
11. The **ESC** function is performing an intervention.
    ESC 正在进行干预
12. The **TSC** function is deactivated or is NOT available.
    TSC 未激活且不可用
13. The **TSC** function is performing an intervention.
    TSC 正在进行干预
14. The driver hands off.
    驾驶员脱手

1.2.4.2 Side-Dependent Un-Availability Condition 与方向有关的不可用条件

The LDP function **Side-Dependent Un-Availability Condition** shall be fulfilled and the function shall become un-available or stay un-available for a **certain side** (**left** or **right**), if **AT LEAST ONE** of the following condition is fulfilled:

若满足以下任一条件，则与方向有关的不可用条件满足

1. No relevant **lane marking** is available on the certain side (left/right).
   某一边（左/右）不存在可用的车道线
2. The LDP function shall be un-available for a **certain side** (**left** or **right**), if the ego-vehicle **turn indicator** is activated into the direction of the certain side.
   若自车该方向的转向灯激活，则功能在该方向不可用
3. If two lane markings are available, which describe the ego-vehicle lane, the ego-vehicle lane width shall be smaller **cLDP_LaneWidthMinTrigger_met - cLDP_LaneWidthHystTrigger_met OR** above **cLDP_LaneWidthMaxTrigger_met + cLDP_LaneWidthHystTrigger_met**.
   若存在两条表明自车车道的车道线，车道的宽度小于 **cLDP_LaneWidthMinTrigger_met - cLDP_LaneWidthHystTrigger_met** 或大于 **cLDP_LaneWidthMaxTrigger_met + cLDP_LaneWidthHystTrigger_met**
   If only one lane marking is available for a certain side (left/right), the condition shall be not fulfilled for the side, on which no lane marking is available.
   若仅有存在一侧车道线，则在没有车道线的方向该条件不满足。
4. The **lane marking** on the certain side (left/right) is unsteady and shows unsteady characteristics.
   在某一边（左/右）车道线不稳定且表现出不稳定特性
5. The LDP function shall be un-available for a **certain side** (**left** or **right**), if the ego-vehicle lateral approaching velocity with regard to a certain lane marking (left or right) is above the threshold **cLDP_VelLatThresMax_mps** + **cLDP_VelLatThresHyst_mps**.
   LDP 功能在某方向不可用，若自车在该方向的横向速度大于 **cLDP_VelLatThresMax_mps** + **cLDP_VelLatThresHyst_mps**

1.2.5 Function Control-Start Condition 功能控制开启条件

Function Control-Start means that the function initiates a lateral intervention.

功能控制开启表明功能开始横向介入。

NOTE: Function Control-Start requires that the Function Activation Condition and Function Availability Condition are fulfilled.
注意：功能控制开启需要功能激活条件和功能可用条件满足

- If the Function Activation Condition is not fulfilled, the function can only be in function De-Activation state. 若功能激活条件为满足，则功能只能处于功能未激活状态
- If the Function Activation Condition is fulfilled, but the Function Availability Condition is not fulfilled, the function can only be in function Un-Availability state. 若功能激活条件满足，但功能可用条件未满足，则功能只能处于功能不可用状态

The LDP function **Control-Start Condition** shall be fulfilled and the function shall only be allowed to start lateral control respecting a certain side (left/right), if **ALL** of the following conditions are fulfilled:

若满足以下所有条件，则 LDP 功能控制开始条件满足：

1. The function **Side-Independent Availability Condition** is fulfilled.
   功能与方向无关的可用条件满足
2. The function **Side-Dependent Availability Condition** is fulfilled for a certain side (left/right), for which the control is started.
   功能与控制开始方向相关的可用条件满足
3. The conditions of at least one **relevant use-case** are fulfilled for a certain side (left/right). Relevant use-cases are **Departure Protection - Lane Departure**
   满足某一方向的用例条件，相关用例为偏离保护
4. The **blocking time** of **cLDP_InterventionBlockingTime_sec** has been passed since the last LDP control has been stopped.
   距上一次 LDP 控制停止超过 **cLDP_InterventionBlockingTime_sec**

1.2.6 Function Control-Finish Condition 功能控制结束条件

Function Control-Finish means that the function stops an ongoing lateral intervention regulary. The Function Control-Finish Condition is a good-case condition and defines the expected function performance.
功能控制结束表明功能正常地停止了正在进行的横向控制。控制结束条件为预期的功能表现。
The LDP function **Control-Finish Condition** shall be fulfilled and the function shall only be allowed to finish lateral control respecting a certain side (left/right), if **ALL** of the following conditions are fulfilled:
若满足以下所有条件，则功能能够结束某一方向的横向介入
- The function **Side-Independent Availability Condition** is fulfilled.
  功能与方向无关的可用条件满足
- The function **Side-Dependent Availability Condition** is fulfilled for a certain side (left/right).
  功能与该一方向相关的可用条件满足
- The **lateral control target** with respect to the use-case and the side (left/right), for which the lateral control was stared, is fulfilled respectively reached.
  该方向横向控制目标已达到
- The **lateral control time** is smaller or equal the maximum control time, which is defined for the use-case, for which the lateral control was started.
  横向控制时间未超过最大控制时间限值

NOTE: The lateral control time is the passed time duration, since the lateral control was started.
注意：横向控制时间从功能控制开始时开始计时

1.2.7 Function Control-Cancel Condition 功能控制取消条件

Function Control-Cancel means that the function cancels an ongoing lateral intervention. The Function Control-Cancel conditions are semi-good-case conditions and are relevant for the cases, for which the function shall stop the lateral intervention, because of a non-regular event.
功能控制取消表明功能取消正在进行的横向控制，该条件针对于非常规情况

The LDP function **Control-Cancel Condition** shall only be fulfilled and the function shall only be allowed to cancel lateral control respecting a certain side (left/right), if **AT LEAST ONE** of the following conditions is fulfilled:
若满足以下任一条件，则功能控制取消条件满足

1. The function **De-Activation Condition** is fulfilled.
   满足功能未激活条件
2. The function **Side-Independent Un-Availability Condition** is fulfilled.
   满足与方向无关的不可用条件
3. The function **Side-Dependent Un-Availability Condition**, is fulfilled for the certain side, for **which the lateral control was initiated**.
   功能与控制开启方向有关的不可用条件满足
4. The **driver overrides** the lateral intervention into the **opposite direction** of the hazardous lane marking via applying a steering torque into the opposite direction of the hazardous lane marking on the steering wheel .
   驾驶员施加手力矩驶离危险车道线

NOTE: The hazardous lane marking is the lane marking, which was approached by the ego-vehicle, when the lateral control was started.
注意：危险车道线为功能控制开启时，自车接近的车道线

5. The **driver overrides** the lateral intervention into the **same direction** of the hazardous lane marking via applying a steering torque into the same direction of the hazardous lane marking on the steering wheel.

   驾驶员通过施加手力矩驶向危险车道线

NOTE: The hazardous lane marking is the lane marking, which was approached by the ego-vehicle, when starting the lateral control.
注意：危险车道线为功能控制开启时，自车接近的车道线

6. The **lateral control time** is bigger as the maximum control time, which is defined for the use-case, for which the lateral control was started.

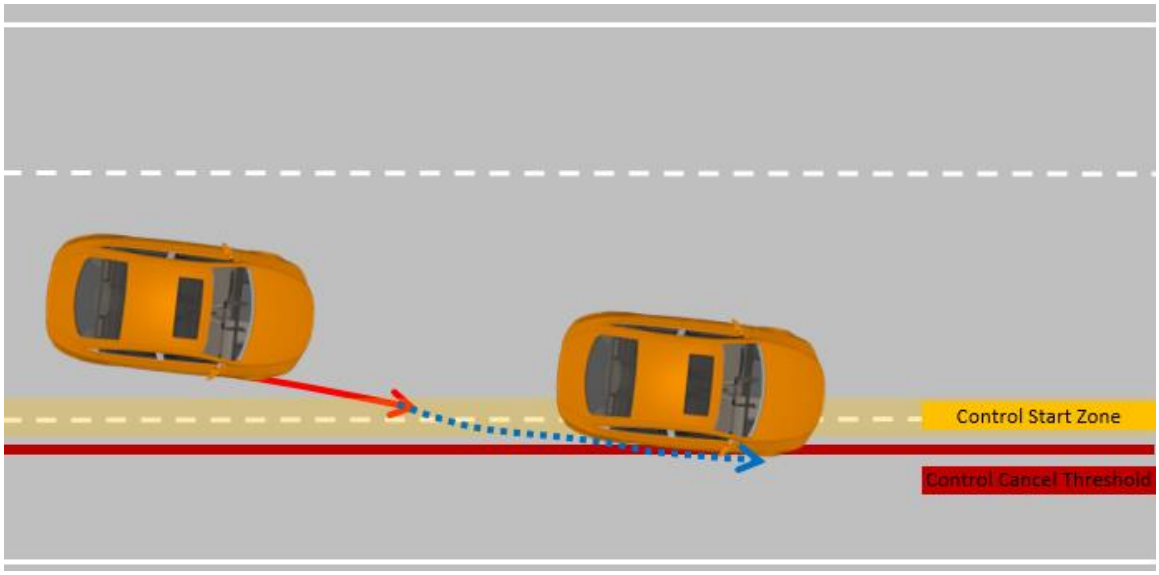
   横向控制时间超过定义的最大控制时间阈值

NOTE: The lateral control time is the passed time duration, since the lateral control was started.
注意：横向控制时间从功能控制开始时开始计时

7. The ego-vehicle **overrides** the **hazardous lane marking** with the outside of the ego-vehicle front wheel by more than 0.5 meter.

   自车的前轮在危险车道线外侧超过 0.5 米

NOTE: The hazardous lane marking is the lane marking, which was approached by the ego-vehicle, when starting the lateral control.
注意：危险车道线为功能控制开启时，自车接近的车道线

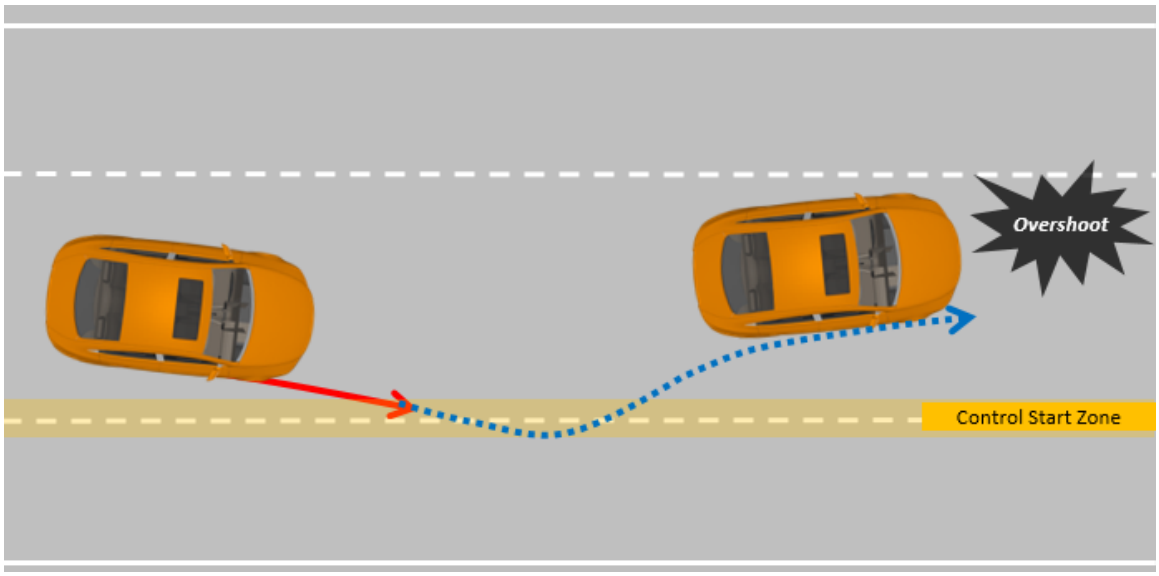


8. The ego-vehicle **overshoots** into direction of the **lane marking on the opposite side during lateral control** and shows probability to cross the lane marking on the **opposite side**.

   自车向危险车道线的反方向超调，且有可能跨过反方向的车道线

NOTE: The opposite side means on opposite side with regard to the hazardous lane marking, which was approached by the ego-vehicle, when starting the lateral control.

注意：反方向指的时危险车道线的对侧



1.2.8 Function Error Condition 功能错误条件

Function Error means that the function detected an error and any function control needs to be prohibited. 功能错误条件表明功能检测到错误，且禁止任何功能控制

The LDP **Function Error Condition** shall only be fulfilled and the function shall show an error, if **AT LEAST ONE** of the following conditions is fulfilled:
若满足以下任一条件，则功能错误条件满足:

1. The **error handling** of the LDP function detected an error, which requires the LDP function to immediately switch off the function.
   LDP 的错误处理检测到错误，需要立即关闭该功能
   NOTE: Relevant errors are
   注意：相关的错误是
   1. Mandatory input signal quality failure
      必须的输入信号质量故障
   2. Mandatory input signal communication failure.
      必须的输入信号通信故障

1.3 Function States 功能状态

The LDP function realizes the following states, which are relevant on vehicle and driver level. The terms in brackets provide additional semantical information for better understanding the pre-condition so that the function is allowed in the certain state:

LDP 功能能够处于如下状态：

1. De-Activated State
   未激活状态
2. (Activated and) Un-Available State
   （激活）不可用状态
3. (Activated and) Available Both Sides State
   （激活）双边可用状态
4. (Activated and) Available One Side State
   （激活）单边可用状态
5. (Activated, Available and) Controlling State
   （激活，可用）控制状态
6. Stopping Control State
   停止控制状态
7. (Activated and) Error State
   （激活）错误状态

1.3.1 Function De-Activated State 未激活状态

1.3.1.1 Conditions 条件

The LDP function shall be in the **Function De-Activated State**, **IF** the **Function De-Activation Condition** is fulfilled.

LDP 功能应处于功能未激活状态，若功能未激活条件满足

1.3.1.2 *Function Behavior 功能行为*

If the LDP function is in the **Function De-Activated State**, it shall realize the following behavior:

若功能处于未激活状态，功能应有以下行为:

1. The LDP function shall show on ego-vehicle **HMI** level that it is **de-activated**.
   功能在 HMI 上显示未激活状态
2. The LDP function shall NOT request any lateral control.
   LDP 不应请求任何横向控制

1.3.2 Function Un-Available State 不可用状态

1.3.2.1 *Conditions 条件*

The LDP function shall be in the **Function Un-Available State**,

IF the **Side-Independent Un-Availability Condition** from is fulfilled

AND IF the **Side-Dependent Availability Condition** is NOT fulfilled for both sides (left and right).

功能应处于功能不可用状态，若与方向无关的不可用条件满足，且左右两侧与方向有关的可用条件不满足

1.3.2.2 *Function Behavior 功能行为*

If the LDP function is in the **Function Un-Available State**, it shall realize the following behavior:

若功能处于功能不可用状态，功能应有以下行为

1. Th The LDP function shall show on ego-vehicle **HMI** level that it is **activated**, but **not available** for lateral control support.
   功能在 HMI 上显示，已被激活但横向控制不可用
2. The LDP function shall NOT request any lateral control.
   功能不应请求任何横向控制

1.3.3 Function Available Both Sides State 双边可用状态

1.3.3.1 *Conditions 条件*

The LDP function shall be in the **Function Available Both Sides State**,

IF the **Side-Independent Availability Condition** is fulfilled **AND IF** the **Side-Dependent Availability Condition** is fulfilled for both sides (left and right).

LDP 功能处于双边可用可用状态，若与方向无关的可用条件满足，且左右两侧的与方向相关的可用条件满足

1.3.3.2 *Function Behavior 功能行为*

If the LDP function is in the **Function Available Both Sides State**, it shall realize the following behavior:

若功能处于两边可用状态，功能应有如下表现:

1. The LDP function shall show on ego-vehicle **HMI** level that it is **activated** and **available** for lateral control support **on both sides** (left and right).
   LDP 功能应在 HMI 上显示，功能已激活且可以提供横向支持
2. The LDP function shall **NOT** request any lateral control, as long as the ego-vehicle is **NOT** under a function **use-case condition** for starting a lateral control.
   功能不应请求横向控制，只要用例中的条件未被满足
3. The LDP function shall **initiate lateral control** for a certain side (left or right) into counter-direction of lane departure, as soon as the **Function Control-Start Condition** is fulfilled.
   只要功能开启条件满足，则功能应开始横向控制

1.3.4 Function Available One Side State 单边可用状态

1.3.4.1 Conditions 条件

The LDP function shall be in the **Function Available One Side State**,

IF the **Side-Independent Availability Condition** is fulfilled

AND IF the **Side-Dependent Availability Condition** is fulfilled **only** for **one** side (left XOR right).

功能应处于单边可用状态，若与方向无关的可用条件满足，且仅有一侧的与方向有关的可用条件满足

1.3.4.2 Function Behavior 功能行为

If the LDP function is in the **Function Available One Side State**, it shall realize the following behavior:

若功能处于单边可用状态，功能应具有以下行为：

1. The LDP function shall show on ego-vehicle **HMI** level that it is **activated** and **available** for lateral control support only for the **certain side** (left XOR right), for which the **Side-Dependent Availability Condition** is fulfilled.
   功能在 HMI 上显示功能已被激活，且仅可以提供一侧的横向控制
2. The LDP function shall **NOT** request any lateral control, as long as the ego-vehicle is **NOT** under a function **use-case condition** for starting a lateral control.
   若用例的条件不满足，功能不应请求横向控制
3. The LDP function shall **initiate lateral control** into counter-direction of lane departure for the **certain side** (left XOR right), for which it shows availability, as soon as the **Function Control-Start Condition** from is fulfilled for the **certain side**.
   只要功能开启条件满足，则功能应开始该方向的横向控制

1.3.5 Function Controlling State 功能控制状态

1.3.5.1 Conditions 条件

The LDP function shall be in the **Function Controlling State**,

IF the **Function Control-Start Condition** was fulfilled for one certain side for at least one point in time

AND IF the **Function Control-Finish Condition** is NOT fulfilled

AND IF the **Function Control-Cancel Condition** is NOT fulfilled

功能应处于控制状态，若功能控制开启条件满足，且功能控制结束条件未满足，且功能控制取消条件未满足

1.3.5.2 Function Behavior 功能行为

If the LDP function is in the **Function Controlling State**, it shall realize the following behavior:

若功能处于功能控制状态，功能应具有以下行为

1. The LDP function shall show on ego-vehicle **HMI** level that it is **activated** and that it is **performing lateral control** for the **certain side** (left XOR right), for which the lateral control was started.
   功能应在 HMI 上显示功能被激活，且正在进行某一方向的横向控制
2. The LDP function shall show on ego-vehicle **HMI** level that the lateral control is **not available** for the side (left XOR right), for which it is NOT performing lateral control.
   功能应在 HMI 上显示功能无法对未控制的方向进行控制
3. The LDP function shall provide **lateral control** in **counter-direction** of the lane departure so that the **lane departure is prevented**.
   LDP 应提供与车道偏离方向相反的横向控制，以防止车道偏离
4. The LDP function **lateral control** shall **align** the ego-vehicle **in parallel** to the lane marking, for which the lateral control was started, after the lane departure has been prevented and the lateral distance between the ego-vehicle and the lane marking is safe again.
   当自车的偏离已被纠回，且自车与偏离车道线的距离达到安全距离，LDP 还需使自车车身与车道线平行
5. The LDP function **lateral control** shall **not overshoot** into counter-direction of prevented lane departure in a way that the ego-vehicle comes close to a lane marking on the opposite side.
   LDP 功能不应纠偏过度，使得自车靠近另一侧的车道线

1.3.6 Function Stopping Control State 功能停止控制状态

1.3.6.1 Conditions 条件

The LDP function shall be in the **Function Stopping Control State**,

IF the function was in **Function Controlling State**

AND (

IF the **Function Control-Finish Condition** was fulfilled

OR IF the **Function Control-Cancel Condition** was fulfilled

)

功能应处于停止控制状态，若功能上一时刻处于功能控制状态，且（功能控制结束条件满足，或功能控制取消条件满足）

1.3.6.2 Function Behavior 功能行为

Finish Condition:

结束条件：

If the LDP function switched into **Stopping Control State**, because

of the **Function Control-Finish Condition** fulfilled, it shall realize the following behavior:

若由于功能控制结束条件满足，功能状态跳转至停止控制状态，则功能应且具有以下行为:

- The LDP function shall ramp out the lateral intervention via a **comfortable steering intervention rampout**, which fulfills the **Lateral Control Request Deactivation Behavior** requirements.

LDP 应通过舒适的介入退出以结束横向干预。

Cancel Condition:
取消条件：
If the LDP function switched into **Stopping Control State**, because
of the **Function Control-Cancel Condition** was fulfilled, it shall realize the following behavior:
若由于功能控制取消条件满足，功能状态跳转至停止控制状态，则功能应具有以下行为
- The LDP function shall ramp out the lateral intervention via a **quick but comfortable steering intervention rampout**, which fulfills the **Lateral Control Request Cancel Behavior** requirements.
LDP 功能应通过快速且舒适的介入退出以取消横向干预
- The LDP function shall show on ego-vehicle **HMI** level that the lateral control is stopped because of a **not regular event**.
LDP 功能应在 HMI 上显示，由于非常规事件，横向控制被停止。

1.3.7 Function Error State 功能错误状态

1.3.7.1 Conditions 条件

The LDP function shall be in the **Function Error State**, **IF** the **Function Error Condition** is fulfilled.

若满足功能错误条件，则 LDP 处于功能错误状态

1.3.7.2 Function Behavior 功能行为

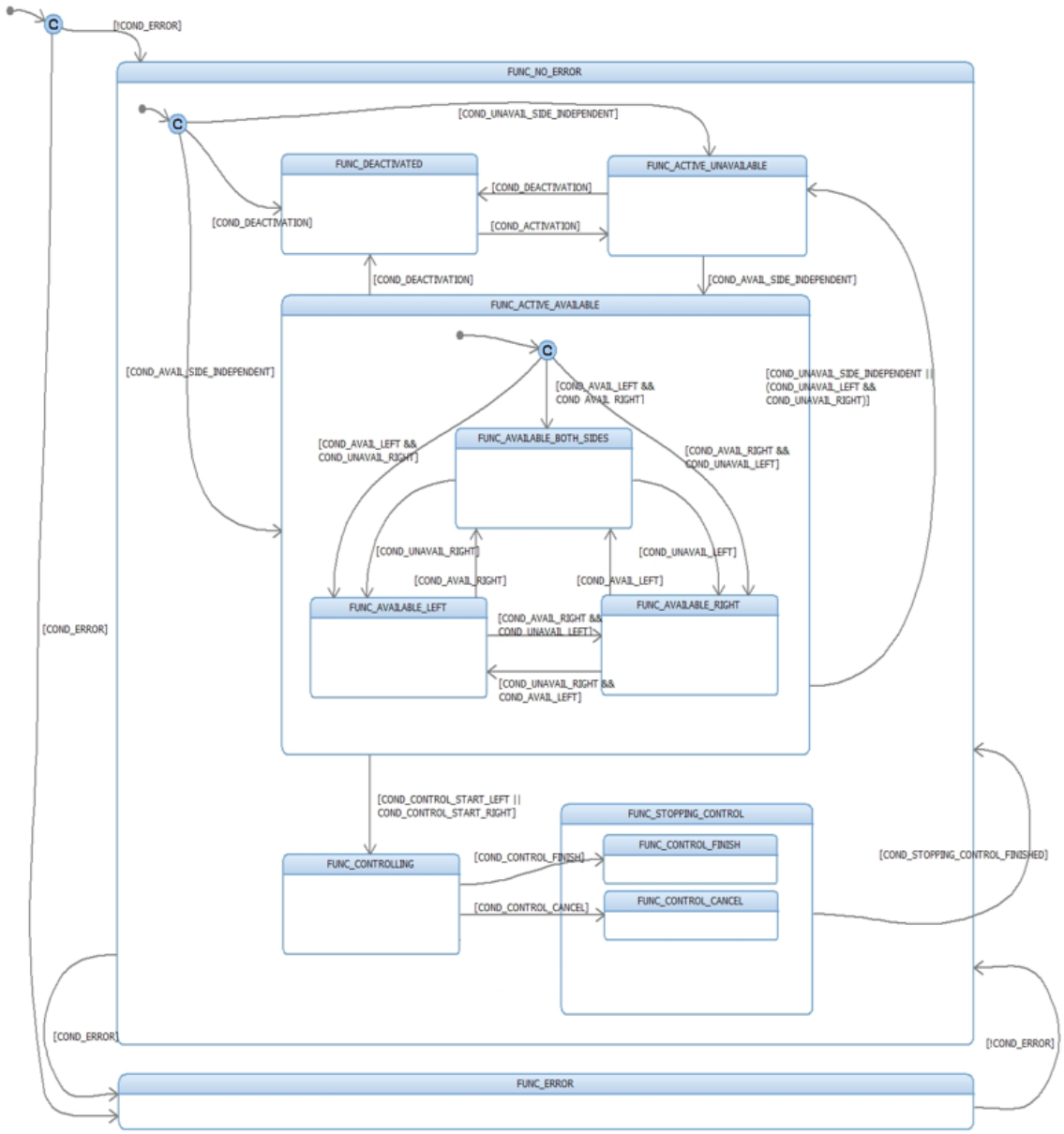
The LDP function shall be in the **Function Error State**, **IF** the **Function Error Condition** is fulfilled.

LDP 功能应处于功能错误状态，若功能错误条件满足：

1. The LDP function shall show on ego-vehicle **HMI** level that it is **not available** because of an **error**.
   功能应在 HMI 上显示由于一个错误功能不可用。
2. The LDP function shall NOT request any lateral control.
   功能不应请求横向控制。
3. The LDP function shall ramp out an ongoing lateral control via a **less comfortable, but quick and safe steering intervention rampout**, which fulfills the **Lateral Control Request Abort Behavior** requirements.
   LDP 功能应通过舒适性较低，但快速且安全的操纵干预退出以中断横向干预

4. The LDP function shall not switch to another function state, before the **Function Error-Recovery Condition** is fullfilled.
   在功能错误恢复条件满足之前，LDP 功能不应跳转至其他功能状态

1.3.8 Function State Chart 功能状态图



Current State	Target State	Conditions	CAN signals Involved(Suggested)
LDP_DEACTIVATED 功能未激活状态	LDP_ACTIVE_UNAVAILABLE 功能不可用状态	COND_ACTIVATION 功能激活条件 COND_UNAVAIL 功能不可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_ACTIVE_UNAVAILABLE 功能不可用状态	LDP_AVAILABLE_BOTH_SIDES 功能双边可用状态	COND_AVAIL_SIDE_INDEPEDENT 功能与边无关的可用条件 且 COND_AVAIL_LEFT 与左侧边有关的可用条件 且 COND_AVAIL_RIGHT 与右侧边有关的可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_AVAILABLE_LEFT 功能左侧边可用状态	COND_AVAIL_SIDE_INDEPEDENT 功能与边无关的可用条件 且 COND_AVAIL_LEFT 与左侧边有关的可用条件 且 COND_UNAVAIL_RIGHT 与右侧边有关的不可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_AVAILABLE_RIGHT 功能右侧边可用状态	COND_AVAIL_SIDE_INDEPEDENT 功能与边无关的可用条件 且 COND_UNAVAIL_LEFT 与左侧边有关的不可用条件 且 COND_AVAIL_RIGHT 与右侧边有关的可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_DEACTIVATED 功能未激活状态	COND_DEACTIVATION 功能未激活条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_AVAILABLE_BOTH_SIDES 功能双边可用状态	LDP_AVAILABLE_LEFT 功能左侧边可用状态	COND_UNAVAIL_RIGHT 功能右侧边不可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout

			0x5=Error 0x6~0x7=reserved
	LDP_AVAILABLE_RIGHT 功能右侧边可用状态	COND_UNAVAIL_LEFT 功能左侧边不可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_CONTROLLING 功能控制状态	COND_CTRLSTRT_LEFT 功能左侧边控制开启条件 或 COND_CTRLSTRT_RIGHT 功能右侧边控开启条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ACTIVE_UNAVAILABLE 功能不可用状态	COND_UNAVAIL_SIDE_INDEPENDENT 功能与边无关的不可用条件 或 (COND_UNAVAIL_RIGHT 与左侧边有关的不可用条件 且 COND_UNAVAIL_LEFT 与右侧边有关的不可用条件)	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_DEACTIVATED 功能未激活状态	COND_DEACTIVATION 功能未激活条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_AVAILABLE_LEFT 功能左侧边可用状态	LDP_AVAILABLE_BOTH_SIDES 功能双边可用状态	COND_AVAIL_RIGHT 功能右侧边可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_AVAILABLE_RIGHT 功能右侧边可用状态	COND_UNAVAIL_LEFT 功能左侧边不可用条件 且 COND_AVAIL_RIGHT 功能右侧边可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_CONTROLLING 功能控制状态	COND_CTRLSTRT_LEFT 功能左侧边控制开启条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ACTIVE_UNAVAILABLE	COND_UNAVAIL_SIDE_INDEPENDENT	LDPSysSts: 0x0=Off

	功能不可用状态	功能与边无关的不可用条件 或 (COND_UNAVAIL_RIGHT 与左侧边有关的不可用条件 且 COND_UNAVAIL_LEFT 与右侧边有关的不可用条件)	0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_DEACTIVATED 功能未激活状态	COND_DEACTIVATION 功能未激活条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_AVAILABLE_RIGHT 功能右侧边可用状态	LDP_AVAILABLE_BOTH_SIDES 功能双边可用状态	COND_AVAIL_LEFT 功能左侧边可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_AVAILABLE_LEFT 功能左侧边可用状态	COND_UNAVAIL_RIGHT 功能右侧边不可用条件 且 COND_AVAIL_LEFT 且功能左侧边可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_CONTROLLING 功能控制状态	COND_CTRLSTRT_RIGHT 功能右侧边控开启条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ACTIVE_UNAVAILABLE 功能不可用状态	COND_UNAVAIL_SIDE_INDEPENDENT 功能与边无关的不可用条件 或 (COND_UNAVAIL_RIGHT 与左侧边有关的不可用条件 且 COND_UNAVAIL_LEFT 与右侧边有关的不可用条件)	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_DEACTIVATED 功能未激活状态	COND_DEACTIVATION 功能未激活条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control

			0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_CONTROLLING 功能控制状态	LDP_CONTROL_FINISH 功能控制结束状态	COND_CTRLFNSH 功能控制结束条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_CONTROL_CANCEL 功能控制取消状态	COND_CTRLCNCL 功能控制取消条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ERROR 功能错误状态	COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_CONTROL_FINISH 功能控制结束状态	LDP_ACTIVE_AVAILABLE 功能可用状态	COND_AVAIL 功能可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_CONTROL_CANCEL 功能控制取消状态	LDP_ACTIVE_AVAILABLE 功能可用状态	COND_AVAIL 功能可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
	LDP_ACTIVE_UNAVAILABLE 功能不可用状态	COND_UNAVAIL 功能不可用条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved
LDP_ERROR 功能错误状态	LDP_NO_ERROR 功能无错误状态	!COND_ERROR 功能错误条件	LDPSysSts: 0x0=Off 0x1=Available 0x2=Unavailable 0x3=Control 0x4=Rampout 0x5=Error 0x6~0x7=reserved

1.4 Function Use-Cases 功能用例

1.4.1 Departure Protection - Lane Departure 偏离保护-车道偏离

The LDP function **Departure Protection - Lane Departure** use-case is the classical LDP function use-case.

LDP 的偏离保护-车道偏离为典型的功能用例

1.4.1.1 *General Behavior 行为*

The LDP function shall realize the following behavior when addressing the **Departure Protection - Lane Departure** use-case:
对于偏离保护-车道偏离，LDP 功能应具有以下表现：

- In case of a lane marking approach of the ego-vehicle, the LDP function shall start the lateral control in counter-direction of an expected lane departure.
当自车偏离车道时，LDP 功能应开始反方向的横向控制
The lateral control shall start at sufficient distance to an approached lane marking, in order to prevent the ego-vehicle from departing the lane.
为了防止自车偏离车道，功能应在距离偏离车道线一定的距离开始控制

- The LDP function shall stop the lateral control in case of preventend lane departure regulary, when the lane departure was prevented and the ego-vehicle was aligned in parallel to priorly approached lane marking.
当偏离已被纠回，且自车与车道线平行，则 LDP 正常地停止横向控制

- The LDP function shall achieve to prevent the lane departure and to stop the lateral control regulary, within a maximum time frame of **cLDP_InterventionCancelControlTimeMax_sec**.
LDP 功能应在 **cLDP_InterventionCancelControlTimeMax_sec** 内完成横向控制

- If the LDP function does not achieve to prevent the lane departure within the time frame of **cLDP_InterventionCancelControlTimeMax_sec**, the lateral intervention shall be stopped.
若 LDP 功能未能在 **cLDP_InterventionCancelControlTimeMax_sec** 内完成控制，则横向控制应被停止

1.4.1.2 *Scenario 1: Departure Protection on Roads with two Lane Markings*
场景 1：双车道线的偏离预警

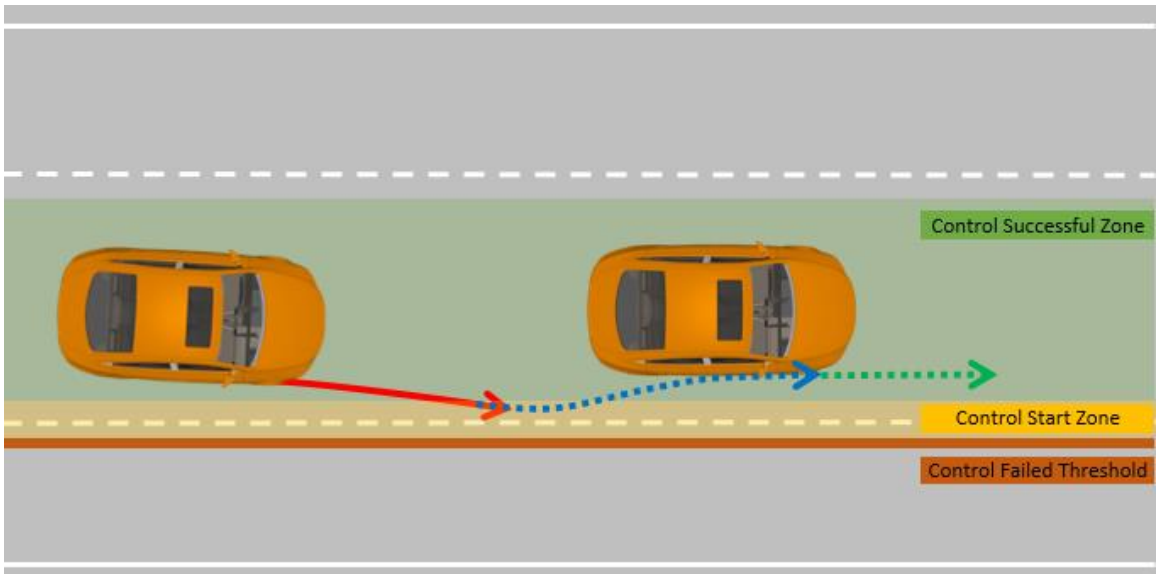
1.4.1.2.1 Scenario 场景

Departure Protection on Roads with two Lane Markings describes the basic scenario for the LDP function, for which the LDP function shall prevent the ego-vehicle from unintended lane departure. The certain characteristic of this scenario is that the **ego-lane** is described by **two lane markings**; one on each side (left/right). The scenario is devided into characteristic sub-scenarios, which have differences in their lateral control strategies.

该场景为 LDP 功能的基本场景，该场景的特点为，定义自车车道的两根车道线存在。该场景又被分为几个子场景，分别具有不同的横向控制策略。

1.4.1.2.2 Sub-Scenario 1.1: Departure Protection on Roads with two Lane Markings - Straight Road

子场景 1.1：双车道线-直路偏离

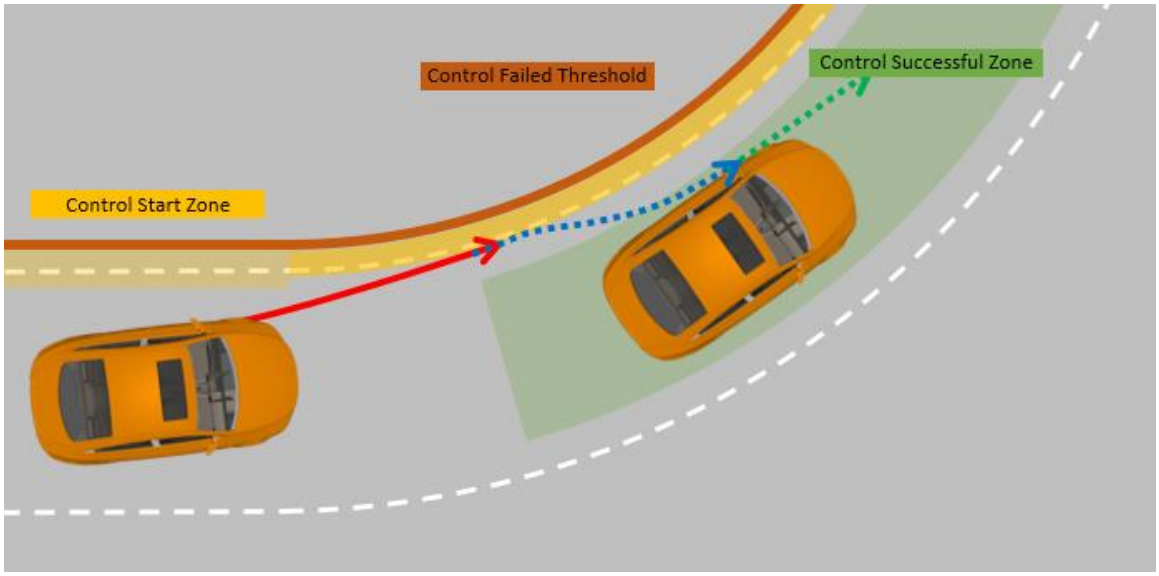


1.4.1.2.2.1 Characteristic Conditions 特征条件

1. The The **Departure Protection on Roads with two Lane Markings - Straight Road Departure** sub-scenario shall be relevant for **straight roads** only.
   该场景只针对于直道

1.4.1.2.3 Sub-Scenario 1.2: Departure Protection on Roads with two Lane Markings - Inner Curve Departure

子场景 1.2：双车道线-内车道线偏离保护

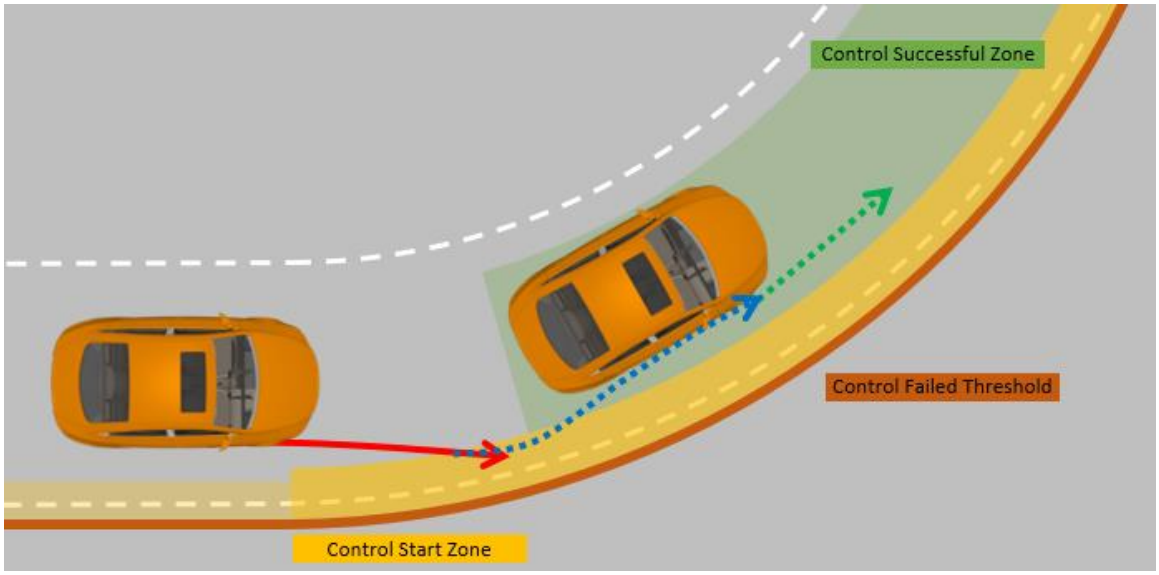


1.4.1.2.3.1 Characteristic Conditions 特征条件

1. The **Departure Protection on Roads with two Lane Markings - Inner Curve Departure** sub-scenario shall be relevant for roads with a **minimum road curve radius** (equal to maximum road curvature). It shall not be relevant for roads with smaller curve radius.
   该子场景仅针对于具有不超过最大车道曲率值的车道
2. The ego-vehicle is approaching a lane marking on the **inner marking** of the curve.
   自车正在往内弯偏离

1.4.1.2.4 Sub-Scenario 1.3: Departure Protection on Roads with two Lane Markings - Outer Curve Departure

子场景 1.3：双车道线-外车道线偏离保护



1.4.1.2.4.1 Characteristic Conditions 特征条件

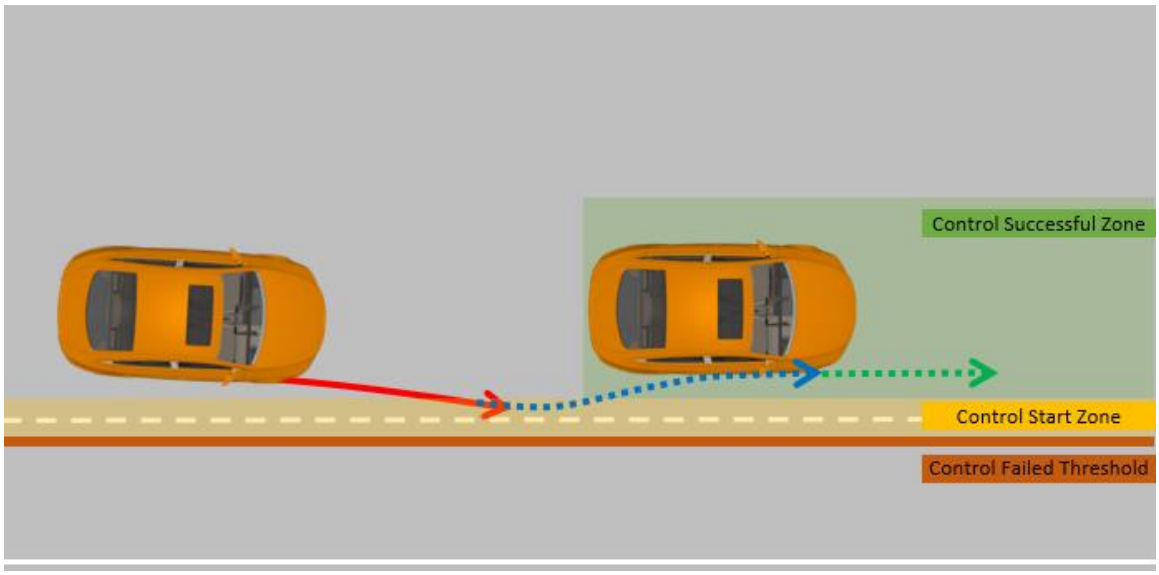
1. The **Departure Protection on Roads with two Lane Markings - Outer Curve Departure** sub-scenario shall be relevant for roads with a **minimum road curve radius** (equal to maximum road curvature). It shall not be relevant for roads with smaller curve radius.
   该子场景仅针对于具有不超过最大车道曲率值的车道
2. The ego-vehicle is approaching a lane marking on the outside marking of the curve.
   自车正在往外车道线偏离

1.4.1.3 Scenario 2: Departure Protection on Roads with only one Lane Marking

场景 2：单车道线

1.4.1.3.1 Sub-Scenario2.1: Departure Protection on Roads with only one Lane Marking - Straight Road

子场景 2.1：单车道线-直道偏离保护



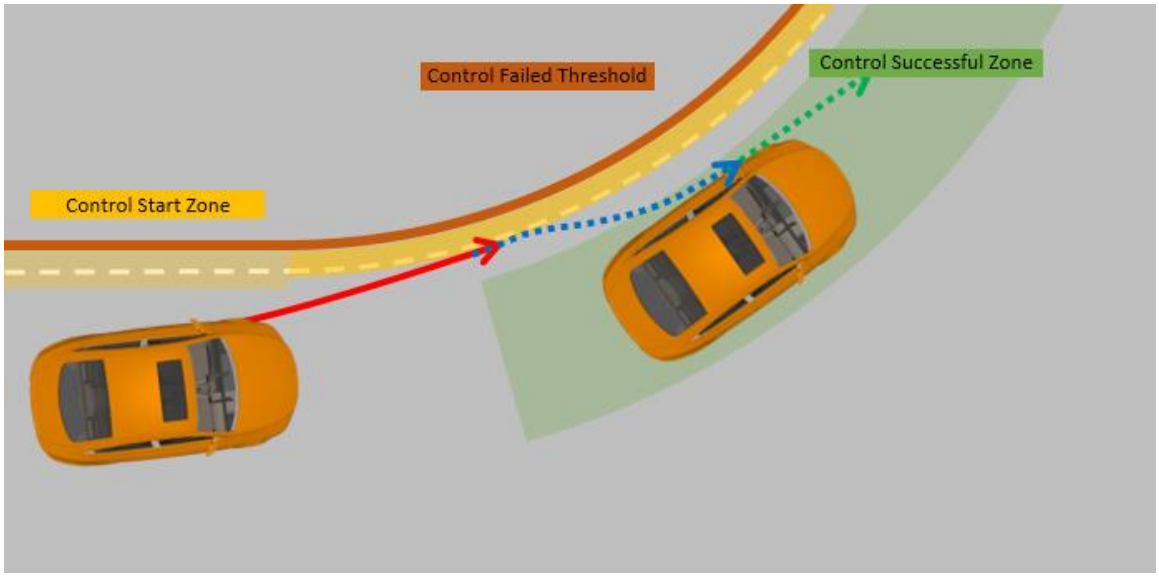
1.4.1.3.1.1 Characteristic Conditions 特征条件

- The **Departure Protection on Roads with only one Lane Marking - Straight Road Departure** sub-scenario shall be relevant for **straight roads** only.

该场景只针对直道

1.4.1.3.2 Sub-Scenario 2.2: Departure Protection on Roads with only one Lane Marking - Inner Curve Departure

子场景 2.2：单车道线-内弯道偏离保护



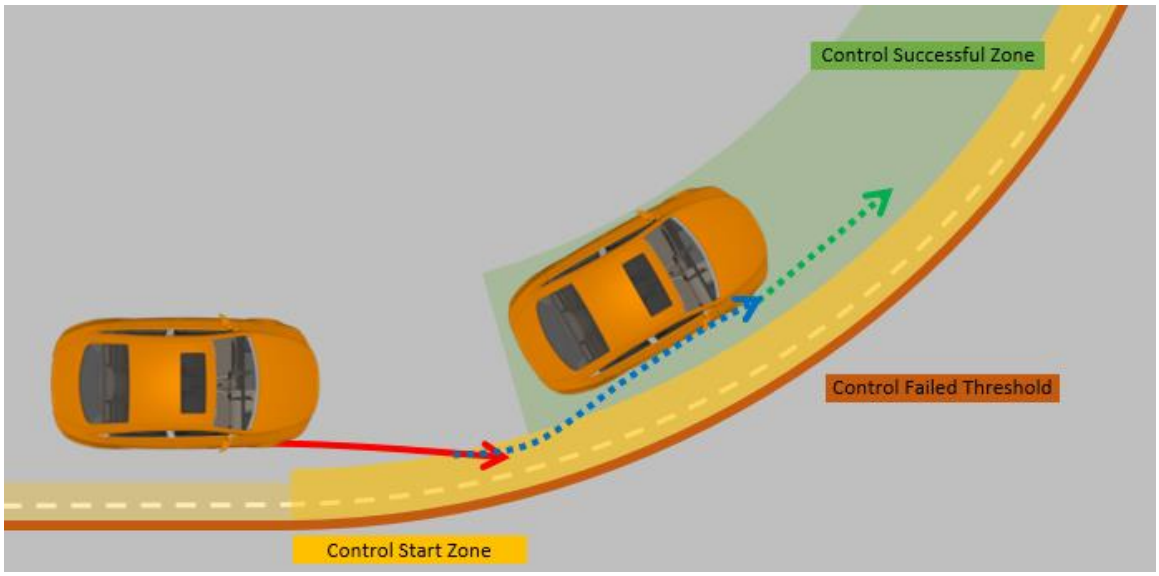
1.4.1.3.2.1 Characteristic Conditions 特征条件

- The **Departure Protection on Roads with only one Lane Marking - Inner Curve Departure** sub-scenario shall be relevant for roads with a **minimum road curve radius** (equal to maximum road curvature). It shall not be relevant for roads with smaller curve radius.

该子场景仅针对于具有不超过最大车道曲率值的车道

- The ego-vehicle is approaching a lane marking on the inner marking of the curve.
  自车正在往内弯道偏离

1.4.1.3.3 Sub-Scenario 2.3: Departure Protection on Roads with only one Lane Marking - Outer Curve Departure
子场景 2.3：单车道-外弯道偏离保护



1.4.1.3.3.1 Characteristic Conditions 特征条件
- The **Departure Protection on Roads with only one Lane Marking - Outer Curve Departure** sub-scenario shall be relevant for roads with a **minimum road curve radius** (equal to maximum road curvature). It shall not be relevant for roads with smaller curve radius.

  该子场景仅针对于具有不超过最大车道曲率值的车道

- The ego-vehicle is approaching a lane marking on the outside marking of the curve.

  自车正在往外弯道偏离

1.5 Handling of System Limits 系统极限处理

1.5.1 Supported Road Types and conditions
支持的道路类型和条件

1.5.1.1 Road Class Definition
道路分类定义

Road Class 1: Dedicated vehicle roads (highways, freeways, high-speed roads) having a non-traversable separation (e.g. guardrail, concrete barrier) to oncoming traffic.

Road Class 1：有隔离带的专用道路（公路，高速公路）

Road Class 2: Main vehicle roads with center lane marking and side lane markings (national roads, country roads).

Road Class 2：有中心线和侧方车道线的主要道路（国道，乡村道路）

Road Class 3: Other paved vehicle roads with visible lane markings but limited width (service roads, urban roads). Center lane marking not mandatory.

Road Class 3：其他有可见车道线，但宽度受限的道路。中心线可以没有。

Road Class 4: Other paved vehicle roads with limited lane marking quality (e.g. washed out or covered markings).

Road Class 4：其他车道线质量有限的道路

Road Class 5: Other paved vehicle roads without lane markings.

Road Class 5：其他没有车道线的道路

1.5.1.2 Bad Road Conditions
不良道路条件

The below road conditions define bad road conditions for which the LDP function is not expected to provide a lateral request support within its required KPI performance:
在以下道路条件下，不期望 LDP 功能提供横向请求支持：

1. Friction rate <= 0.3 (low μ, e.g. black ice, snow, aquaplaning, ...)
   摩擦系数<=0.3（雪，冰，水）
2. Bumpy roads with potholes
   坑洼不平的道路
3. Roads with any bad conditions that affect the ego-vehicle driving behavior in a way that the driver has to correct the vehicle's course
   道路不良条件会影响自车驾驶行为，需驾驶员纠正车辆行驶线路

The function shall offer support for all highway scenarios, national roads and country roads, which provide at least a minimal lane width and detectable lane markings. This excludes:
功能应在所有具有最小车道宽度且车道线质量良好的高速公路，国道，省道提供支持。这不包括：

1. Urban roads
   城市道路
2. Secondary roads, Service roads
   二级公路，服务道路
3. Dirt roads
   泥路
4. Parking lots, Parking garages, Driveways
   停车场，车库，私人车道
5. Entry/Exit Ramps
   出入口

The function shall offer support for the following Road Classes (see *Road Class Definition*):
功能需在以下的道路分类提供支持：

1. Road Class 1
2. Road Class 2

3. Road Class 3

For the following Road Classes, the function may activate but is not supposed to reach the required KPIs:
对于以下道路类别，功能可被激活，但不能够提供有效控制：

Road Class 4

The function shall not offer support for the following Road Classes (see Road Class Definition):
功能不支持以下道路类别

Road Class 5

1.5.2 Supported Lane Marking Types 支持的车道标识线种类

The LDP function shall offer support for all lane marking types, which show a continuous course behavior. This excludes special lane markings, which are not supposed to define a road course (e.g. like zik-zak lines, which show forbidden driving areas).

LDP 应对所有连续的车道线提供支持，这不包括不能用于定义车道的车道线（例如：齿距状的车道线）

Supported lane marking type set includes:

支持的车道标识线包括：

1. Single line straight/dotted
   单实/虚线
2. Double line straight/dotted
   双实/虚线
3. Triple line straight/dotted
   三实/虚线
4. Combinations of before mentioned lane markings
   以上标识线的组合

1.5.3 Supported Lane Marking Colors 支持的车道标识线颜色

The LDP function shall offer support for all lane marking colors, which are commonly used.

LDP 功能应对常用的车道线颜色提供支持。

Supported lane marking colors basically includes:

支持的车道标识线颜色包括：

1. White lines
   白线
2. Yellow/orange lines
   黄/橙线
3. Red lines
   红线
4. Blue lines
   蓝线

1.5.4 Supported Curve radius 支持的弯道半径

The LDP function should work properly for road curvatures in the interval of [(-1) * *TCurvatureThreshold*, *TCurvatureThreshold*] 1/m. The *TCurvatureThreshold* value shall depend on the ego-vehicle velocity (defined by the lookup mapping between **cLDP_LaneMarkingCurvThTriggerLookupX_kph** and **cLDP_LaneMarkingCurvThTriggerLookupY_1pm**).
LDP 功能应对车道曲率在[(-1) * *TCurvatureThreshold*, *TCurvatureThreshold*]范围之内的车道提供支持。*TCurvatureThreshold* 的值与速度相关，通过查表可得

1.5.5 Supported Environmental conditions 支持的环境条件

Environment conditions like rain, sunlight do affect the LDP function performance directly, since they affect the detection of lane markings. Nevertheless, for little environment limitations the LDP function shall provide reliable performance.

由于环境条件，例如雨，阳光会影响到车道线的检测，因此它们的出现会直接影响到 LDP 功能的性能。但是在较小的环境限制下，LDP 功能应提供可靠的性能表现

The LDP function is allowed to show limited performance, if one of the following environment restrictions or a combination of them applies

若以下任意环境限制或它们的组合发生，则允许 LDP 功能出现有限的性能：

1. Fog with visual range less than 50 meters
   可见度小于 50 米的雾
2. Heavy rain/mist at day
   白天的大雨/薄雾
3. Normal rain/mist at night
   夜晚的雨/薄雾
4. Glare from sunlight (deep sun on sunrise or sunset)
   太阳强光（日出或日落）
5. Snow/ice on the road.
   路上的雪/冰
6. Snowfall at day and night.
   白天和夜晚的降雪
7. Light reflection from wet or salty road surface
   来自潮湿或含盐的道路表面的光照反射

2. Parameter List 参数列表

Parameter Name	Description	Recommanded Value	Unit
cLDP_VehicleSpeedMin_kph	Minimum allowed value of the displayed longitudinal velocity for the LDP 最小速度	50	Km/h

cLDP_VehicleSpeedMax_kph	Maximum allowed value of the displayed longitudinal velocity for the LDP 最大速度	145	Km/h
cLDP_VehicleSpeedMinHyst_kph	Hysteresis below the minimal threshold of the ego-vehicle's velocity 最小速度滞后	5	Km/h
cLDP_VehicleSpeedMaxHyst_kph	Hysteresis above the maximal threshold of the ego-vehicle's velocity 最大速度滞后	5	Km/h
cLDP_LaneWidthMinTrigger_met	Minimum allowed value of the lane width for the LDP 最小车道宽度	2.5	Meter
cLDP_LaneWidthMaxTrigger_met	Maximum allowed value of the lane width for the LDP 最大车道宽度	5.5	Meter
cLDP_LaneWidthHystTrigger_met	Hysteresis about the lane width 车道宽度滞后	0	Meter
cLDP_VehLongAccelerationThTrigger_mpss	Tolerated max. longitudinal acceleration to allow LDP to start a lateral intervention 最大纵向加速度	3	Meter/S^2
cLDP_VehLongDecelerationThTrigger_mpss	Tolerated max. longitudinal deceleration to allow LDP to start a lateral intervention 最大纵向减速度	-3	Meter/S^2
cLDP_VehLatAccelerationThTrigger_mpss	Maximum allowed value of the lateral acceleration for the LDP 最大横向加速度	5	Meter/S^2
cLDP_VelLatThresMax_mps	Maximum allowed value of the lateral velocity for the LDP 最大横向速度	1	Meter/S
cLDP_VehLongAccelerationThHyst_mpss	Hysteresis of longitudinal acceleration 纵向加速度滞后	0.05	Meter/S^2
cLDP_VehLongDecelerationThHyst_mpss	Hysteresis of longitudinal deceleration 纵向减速度滞后	0.05	Meter/S^2
cLDP_VehLatAccelerationThTriggerHyst_mpss	Hysteresis of lateral deceleration 横向减速度滞后	0.05	Meter/S^2
cLDP_LaneWidthHystTrigger_met	Hysteresis about the lane width 车道宽度滞后	0	Meter
cLDP_VelLatThresHyst_mps	Hysteresis of the lateral velocity 横向速度滞后	0.1	Meter/S
cLDP_InterventionBlockingTime_sec	Duration of the blocking time between two LDP warning request. 功能介入间隔时间	2	Second
cLDP_InterventionCancelControlTimeMax_sec	Duration of the cancelling time between two LDP warning request. 功能介入取消时间	20	Second
cLDP_LaneMarkingCurvThTriggerLookupY_1pm	The threshold curvature for lane marking. 车道线的曲率阈值	1/200	1/meter