



# The Future of Driving: Implications for Teen Drivers



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# Presentation

Overview of Automated Vehicles

What Can you Buy Now? ADAS Features

Problems with ADAS Systems

Implications for Teen Drivers

The Near- and Long-Term Future

Conclusion



# Overview of Automated Vehicles

# What people think of





# What people think of



# The Promise of Full Automation



<https://www.youtube.com/watch?v=CqSDWoAhvLU>



# Terminology

Autonomous vehicles  Self-driving vehicles

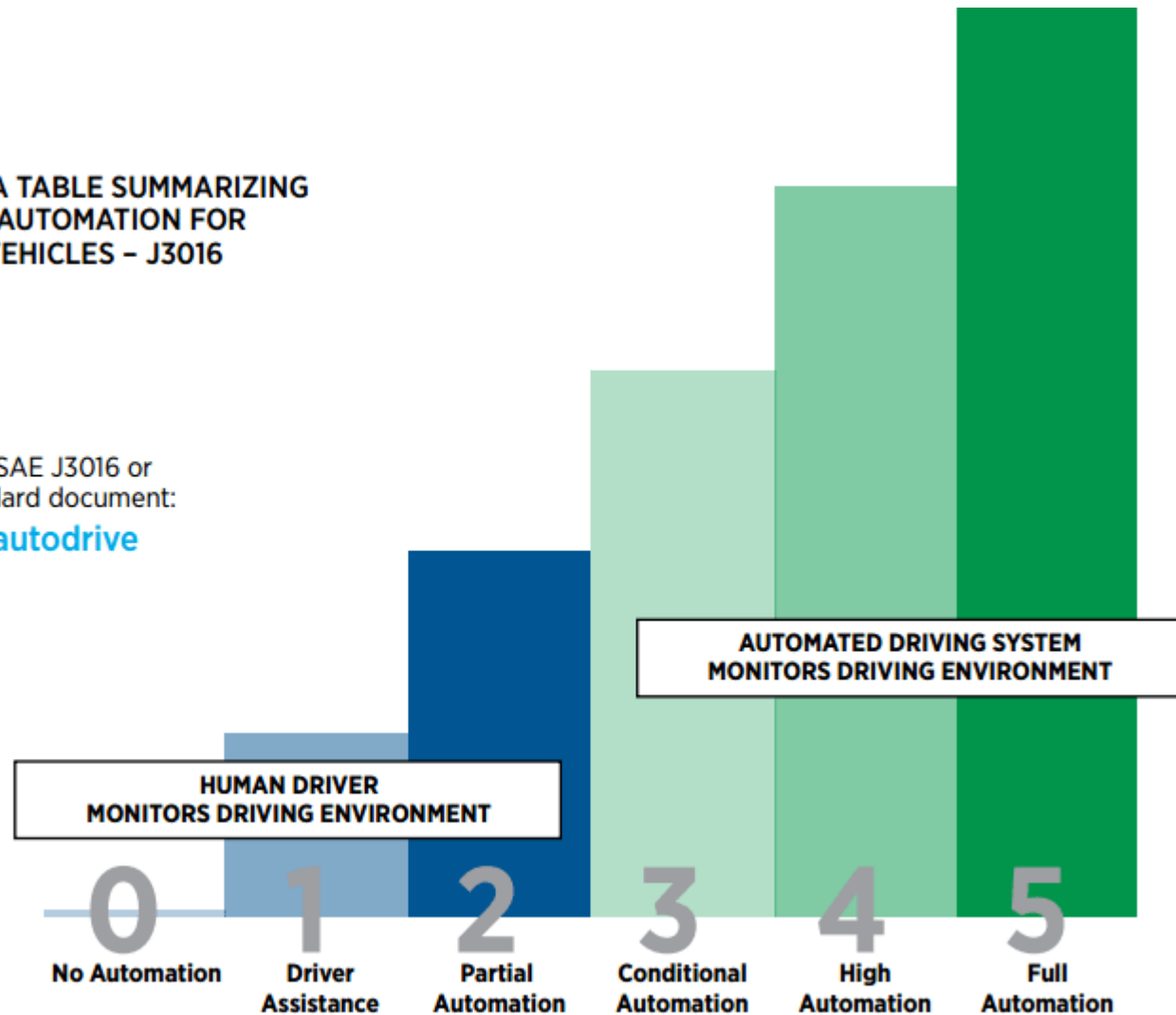
Automated vehicles

Highly automated vehicles

# Levels of Automation

▶ OVER FOR A TABLE SUMMARIZING LEVELS OF AUTOMATION FOR ON-ROAD VEHICLES - J3016

Learn more about SAE J3016 or purchase the standard document:  
[www.sae.org/autodrive](http://www.sae.org/autodrive)







# Levels of Automation: Market Availability

Level 1 – Advanced Driver Assistant Systems

Level 2 – Advanced Driver Assistant Systems

Level 3 – None on the market

Level 4 – None on the market

Level 5 – None on the market -> Google Car



# What Can I Buy Right Now?



# Available Features



<https://mycardoeswhat.org/the-future/>



# ADAS

## Advanced Driver Assistance System(s)

### Examples:

- Adaptive Cruise Control
- Blind Spot Monitor
- Lane Departure Warning
- Adaptive Headlights
- Automatic Parallel Parking
- Rear Cross Traffic Alert





# Example: How Adaptive Headlights Work

**INSURANCE INSTITUTE  
FOR HIGHWAY SAFETY**

<https://www.youtube.com/watch?v=mN12Ruex3m0>

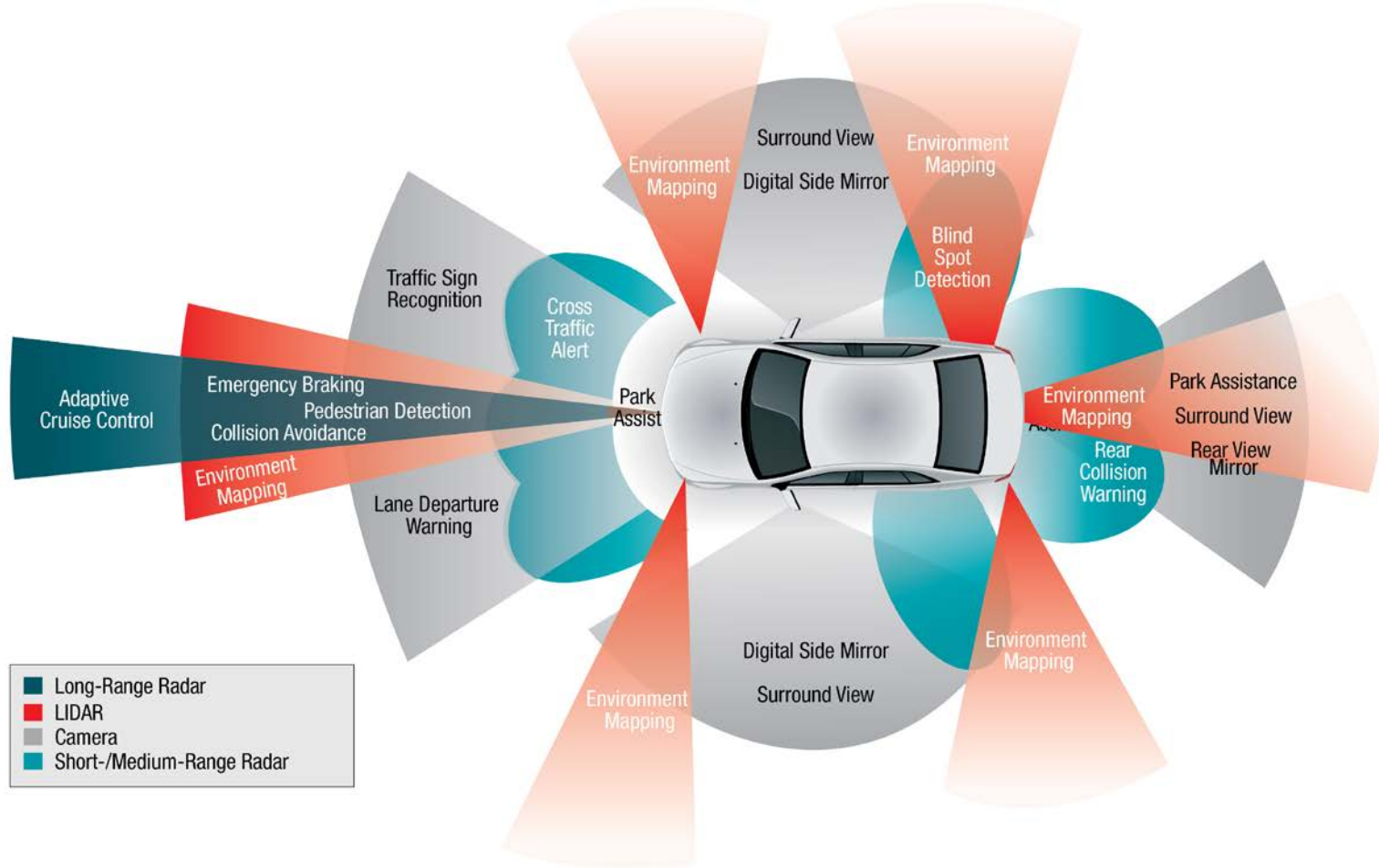


# Example: How Adaptive Cruise Control Works

**INSURANCE INSTITUTE  
FOR HIGHWAY SAFETY**

<https://www.youtube.com/watch?v=GInSPWZRFRM>

# How They Work



# Examples of ADAS: 2018 Models

## Mercedes C-Class



Watches the driver ahead. And the one behind the wheel.

C-Class safety keeps an eye on your future. Radar helps spot hazards in your path. A team of standard and optional systems can monitor all around you, alert you, help you brake, and even respond on your behalf to help reduce collisions. <sup>[5]</sup>



# Examples of ADAS: 2018 Models

## Ford Taurus

Explore 2017 Taurus



Features

Local Offers

Build & Price

Search Inventory



### BLIS® with Cross-Traffic Alert

The available BLIS (Blind Spot Information System) with Cross-Traffic Alert<sup>10</sup> uses radar in the rear quarter panels to detect a vehicle entering your blind spot and alerts you with an indicator light in the sideview mirror.

Cross-traffic alert also uses radar to watch for traffic behind you when you're slowly backing out of a parking spot or your driveway. If it detects a vehicle approaching from up to 15 yards away, it provides an audible warning, a visual display in either sideview mirror and a signal in the message center. BLIS technology is standard on Taurus Limited and SHO models.

# Examples of ADAS: 2018 Models



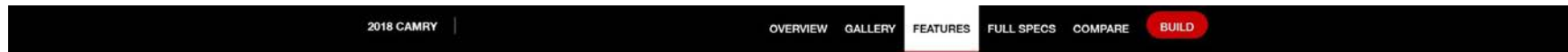
## Lane-Keeping System

The available Lane-Keeping System<sup>10</sup> includes both the lane-keeping alert and the lane-keeping aid. The system can operate during the day or night. Lane-keeping alert warns you through a series of steering wheel vibrations, which mimic driving over a rumble strip, should the system detect an unintentional lane departure.

Lane-keeping aid actively applies steering torque, which alerts you to direct your vehicle back into the target lane should the system detect an unintended lane departure. The system is available on Taurus Limited and SHO models.\*

\*Lane-Keeping System does not control steering.

# Examples of ADAS: 2018 Models Toyota Camry



Standard Toyota Safety Sense™ P (TSS-P) Performance, Design, Interior, Information Technology, Interior Customization, Model, Safety

## Standard Toyota Safety Sense™ P (TSS-P)

It's got your back. And sides. And front.



### Pre-Collision System with Pedestrian Detection

Using an in-vehicle camera and radar to help detect a vehicle or a pedestrian in front of you, the Pre-Collision System (PCS)<sup>23</sup> with Pedestrian Detection<sup>23</sup> (PCS w/PD) can help you mitigate or avoid a potential collision. If the system determines that a frontal collision is likely, it prompts you to take action using audio and visual alerts. If you notice the potential collision and apply the brakes, PCS w/PD may apply additional force using Brake Assist.<sup>24</sup> If you don't brake in time, it may automatically apply the brakes to reduce your speed, helping to minimize the likelihood of a frontal collision or reduce its severity.



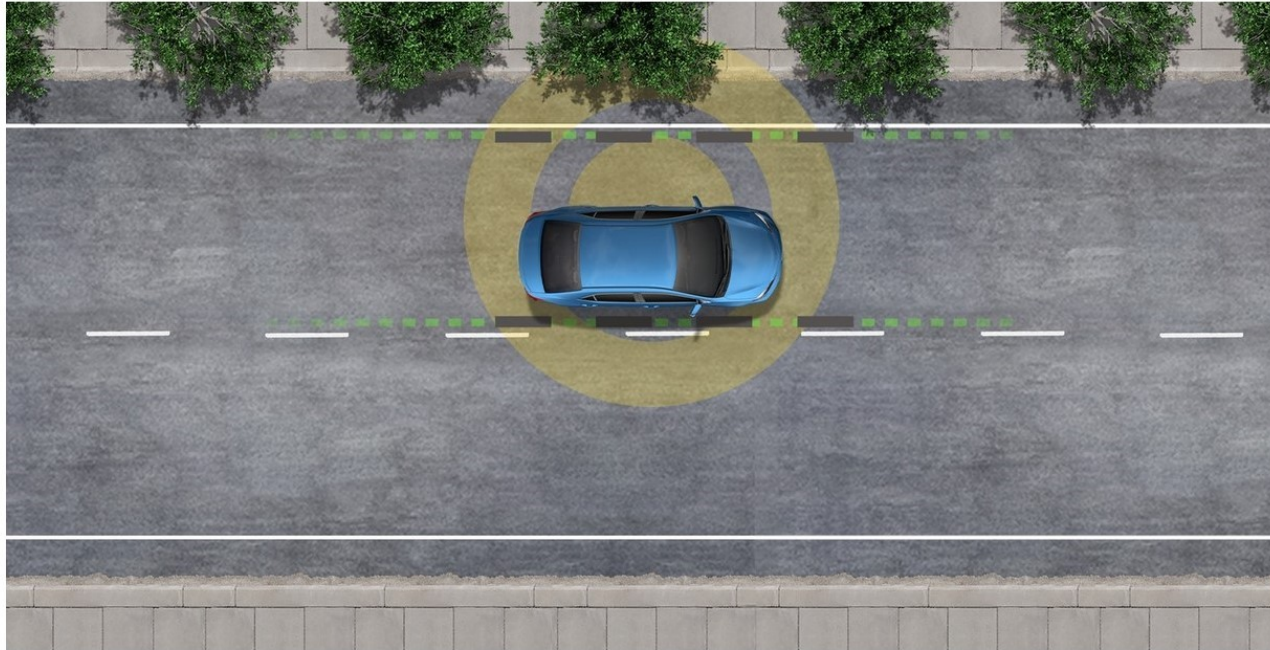
### Lane Departure Alert with Steering Assist

Under certain circumstances, Lane Departure Alert (LDA)<sup>25</sup> is designed to detect lane departure or LDA only activates when you're traveling at a speed of 32 mph or faster. When you hear and see it checking the road around you, you should safely direct your vehicle back to the center of your lane. Toyota Safety Sense™ P (TSS-P)<sup>25</sup> and Electronic Power Steering (EPS) include Steering Assist<sup>22</sup> activated and senses that you're unintentionally drifting, the system may automatically make small help keep your vehicle in its lane.

# Examples of ADAS: 2018 Models

## Standard Toyota Safety Sense™ P (TSS-P)

It's got your back. And sides. And front.



### Lane Departure Alert with Steering Assist

Under certain circumstances, Lane Departure Alert (LDA) <sup>29</sup> is designed to detect lane departure on roads with clear markings. LDA only activates when you're traveling at a speed of 32 mph or faster. When you hear and see the alert, after carefully checking the road around you, you should safely direct your vehicle back to the center of your lane. In addition, Camry's Toyota Safety Sense™ P (TSS-P) <sup>25</sup> and Electronic Power Steering (EPS) include Steering Assist <sup>22</sup> functionality. When it's activated and senses that you're unintentionally drifting, the system may automatically make small corrective steering inputs to help keep your vehicle in its lane.



# ADAS: Fine Print

Explore 2017 Taurus

Features

Local Offers

Build & Price

## Intelligent Access with Push-Button Start

Starting Taurus is a breeze, thanks to available Intelligent Access with push-button start. With the key fob in your pocket or handbag, simply open the driver's

10

Driver Assist Features are supplemental and do not replace the driver's attention, judgment and need to control the vehicle.

streaming internet-based features require an active subscription to the mbtracE Entertain Package. Connection may be limited by cellular signal. Apps may be introduced and updated at varying dates, and may also require a vehicle software update. Some services may be limited or restricted in some areas. Driver is responsible for complying with traffic and other laws. See your dealer or MBUSA.com/mercedesme for details. The Mercedes me Mobile App is compatible with Apple iPhone® models running iOS 7.0 or later, and Android-based phones running OS 2.3 or later.

[5] COLLISION PREVENTION ASSIST may not be sufficient to avoid an accident. It does not react to certain stationary objects, nor recognize or predict the curvature and/or lane layout of the road or every movement of vehicles ahead. It is the driver's responsibility at all times to be attentive to traffic and road conditions, and to provide the steering, braking and other driving inputs necessary to retain control of the vehicle. Drivers are cautioned not to wait for the system's alerts before braking, as that may not afford sufficient time and distance to brake safely. See Operator's Manual for system's operating speeds and additional information and warnings.



# The Fine Print

ADAS features are limited by:

- The technology being used
- Weather conditions
- Roadway characteristics
- The driver's understanding of the system and willingness to use or not use the technology



# Real World Use

What we know from research done with experienced drivers.

- Limited knowledge about these systems and their limitations
- Confusing terminology
- Overreliance on technology

# An Example of Extreme Misuse



<https://www.youtube.com/watch?v=pJ4-2d7C6gg>



# Implications for Teen Drivers



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# Teen Driver Risks

- Inexperience
- Risky behavior
- Drive older, smaller, vehicles



# What are teens driving?

2015 study showed that:

- 41% were driving a 2000-2006 model year vehicle.
- 19% were driving a vehicle from 1999 or older.
- 30% were driving a newer vehicle (2007 or newer).



# Implications for Teen Drivers

- May learn in a vehicle with some ADAS technologies
- May drive independently in a vehicle without these technologies
- Parents/Guardians may have limited knowledge about system
- Transition between vehicles



# Researchers' Concerns

- Overreliance on technology
- Engage in secondary tasks more frequently



# Research

## 2017 Study

- Lane departure warnings were helpful
- Increased use of turn signals
- Negative effect on following behavior
- No increase in secondary task behavior





# Potential Benefits

- Assist teens in learning process
  - Example Lane Keep Assist
  - Act as a “virtual” supervisor
- Benefits for experienced drivers benefit novice drivers
  - Adaptive headlights



# Results from the NCPDSA Fall 2017 Conference



# Discussion Question 1

What ADAS features may be helpful to teen drivers?



# Discussion Question 1

List of features considered:

- Back-up Camera
- Blind Spot Monitor
- Automatic Emergency Braking
- Lane Departure Warning/Lane Keeping Assist
- Adaptive Cruise Control
- Adaptive Headlights
- Automatic Parallel Parking
- Forward Collision Warning
- Rear Cross Traffic Alert



# Results for Discussion Question 1

Helpful	Not Helpful
Blind Spot Warning	Backup Camera
Automatic Emergency Braking	
Lane Departure Warning	
Lane Keeping	
Adaptive Cruise Control	
Adaptive Headlights	
Automatic Parallel Parking	
Forward Collision Warning	
Rear Cross Traffic Alert	





## Discussion Question 2

How do you see the role and content of drivers' education change as more of these technologies become available in the marketplace?

- Teaching teen drivers how to deal with an emergency if the technology fails.



# Concerns

- Worried about transitioning from/to older cars or between cars with and without ADAS features.
  - Different types of vehicles with different features in a family
- Net effect is to take the average driver “out of the loop” (i.e. inattention to driving task) making teens too comfortable.
  - Inattention to driving task
  - Complacency
- In the long-term maybe a net gain in safety but in the short-term it may be a tough transition for Drivers’ Education instructors



# Questions

- How many of you have back up cameras on your vehicle?
- How many of you have any of the other features I've spoken about on your vehicle?
- Have you encountered students that have been exposed to these technologies?



# The Near- and Long-Term Future



# The Future of the Vehicle Fleet Overall

“Some drivers rarely replace their vehicles, so changes to new models don't reach the entire fleet for decades.”

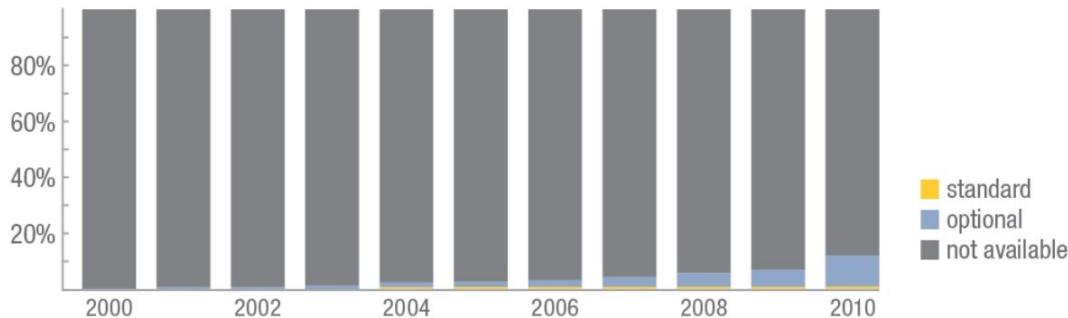


# ADAS Market Characteristics

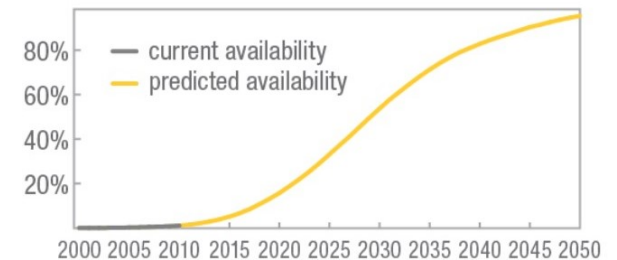
## Forward collision warning

Forward collision warning is available primarily on luxury vehicles, although recently it also has been offered by Ford, Chrysler, and other nonluxury brands. It first appeared on a U.S. car in model year 2000 and was standard on just 1 percent of 2005 models and optional on 2 percent. In 2010, it was standard on 1 percent and optional on 11 percent of models. If it continues to follow this pattern, it will be available on 95 percent of registered vehicles in 2049. However, if further research confirms the benefits of the technology, it could be expected to move faster.

Percent of new vehicle models with forward collision warning



Predicted percentage of registered vehicles with forward collision warning





# Teens and Vehicle Technology



# We Need Your Input!



[https://unc.az1.qualtrics.com/jfe/form/SV\\_0ALqvruOEXdf9v7](https://unc.az1.qualtrics.com/jfe/form/SV_0ALqvruOEXdf9v7)

# The Promise of Technology

Ultimately the goal of this technology is to reduce crashes that are associated with human error.





# Questions? Comments?



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Thank you!

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