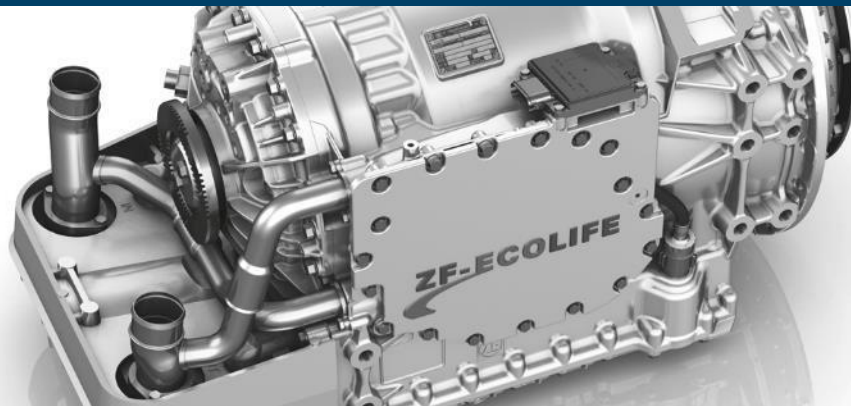




EcoLife – optimal for BRT

Commercial Vehicle Technology



Bus Rapid Transit

Contents

- Initial Situation
- BRT – What's that?
- BRT requirements with regard to bus and driveline
- EcoLife – the best BRT driveline transmission
- EcoLife highlights
- References
- More than mere transmissions – special ZF offers



Urban Development Across the Globe

Cities are growing all over the world:

- Rising population density
- Traffic congestion
- Increasing land consumption

The challenges are increasing, too:

- The environmental impact
 - Noise and air pollution
- Passenger transport becomes more difficult
 - More and more vehicles on congested roads
- Reduction of quality of life



Urban Public Transport Networks (UPTN) Which Deploy Buses

**With this in mind, the cities must aim at:
improving passenger transport**

Strengthening of UPTN (bus lines):

Conventional systems:

- Informal transit service
- Conventional bus service
- Simple bus lines

Bus Rapid Transit Systems:

- BRT lite (extended bus service)
- Standard BRT
- Full BRT



Definition of transport systems acc. to:
Bus Rapid Transit Planning Guide, June 2007
Institute for Transportation & Development Policy, New York

BRT

What's That?

Goal: Improvement of Passenger Transport

Bus Rapid Transit Systems:

- **BRT lite** (Extended Bus Service)
Bus priority but not entirely separate bus lanes, quicker schedules, improved bus stops, buses with good environmental standards, marketing identity
- **Standard BRT**
Separate lanes, usually pre-paid ticketing, higher-quality bus stops, vehicles with good environmental standard, marketing identity
- **Full BRT**
Metro service, integrated network of routes and corridors, enclosed, high-quality bus stops, pre-paid ticketing, quick journeys with scheduled cycles, buses have latest environmental standards, marketing identity, excellent customer service.

Advantages of BRT

Efficient • cost-effective • eco-friendly

Bus Rapid Transit Features



Essential attributes of BRT (using Full BRT as an example):

- Separate traffic lanes
- Efficient stops with pre-board ticketing
- Buses with high passenger-carrying capacity
- Step-free access:



Bus Rapid Transit

BRT Bus Requirements

BRT buses meet high requirements:

- Transport **many** passengers

- Transport many passengers **quickly**

General requirements:

- Cost-efficient

- Comfortable

- Environmentally friendly

BRT buses require:

High-capacity, many doors,
step-free access

High average speed

Reduced fuel consumption,
low life cycle cost

Smooth shifting /
braking. Low noise

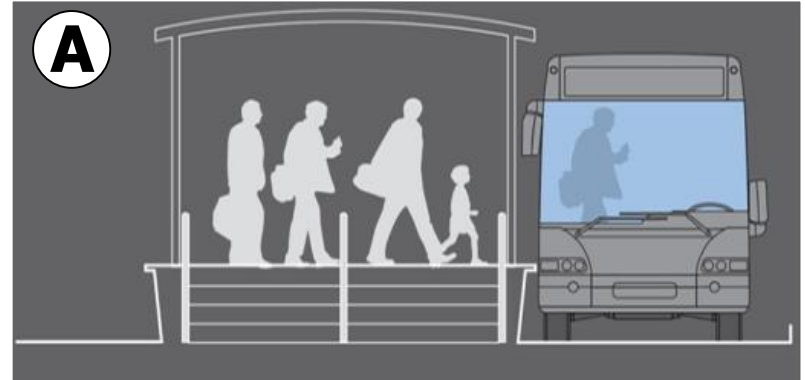
Low-emission

Transport Many Passengers Quickly

Platform Concepts

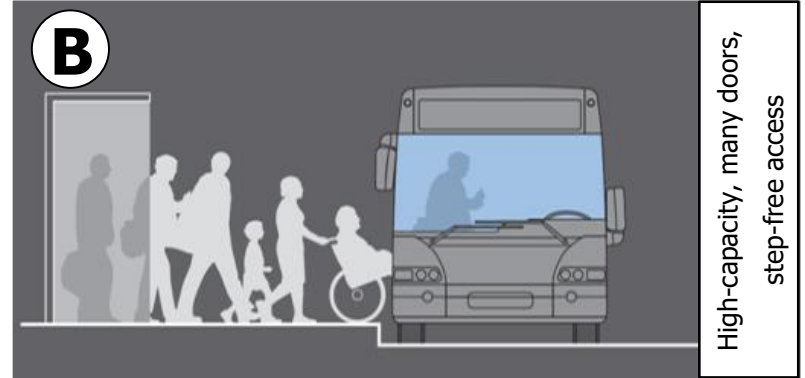
- **Boarding platform**

- High-floor buses
- Example: Johannesburg



- **Sidewalk platform**

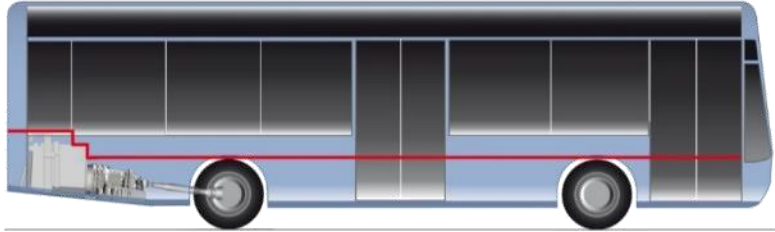
- Low-floor buses
- Example: Istanbul



BRT Buses

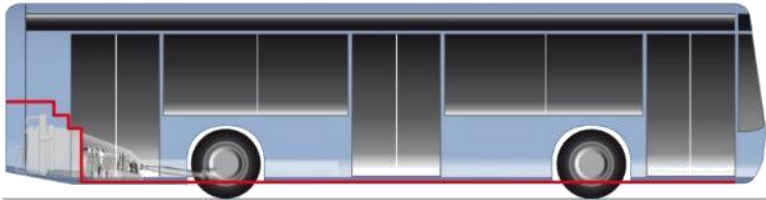
Suitable for all Platform Concepts

A High-floor bus:



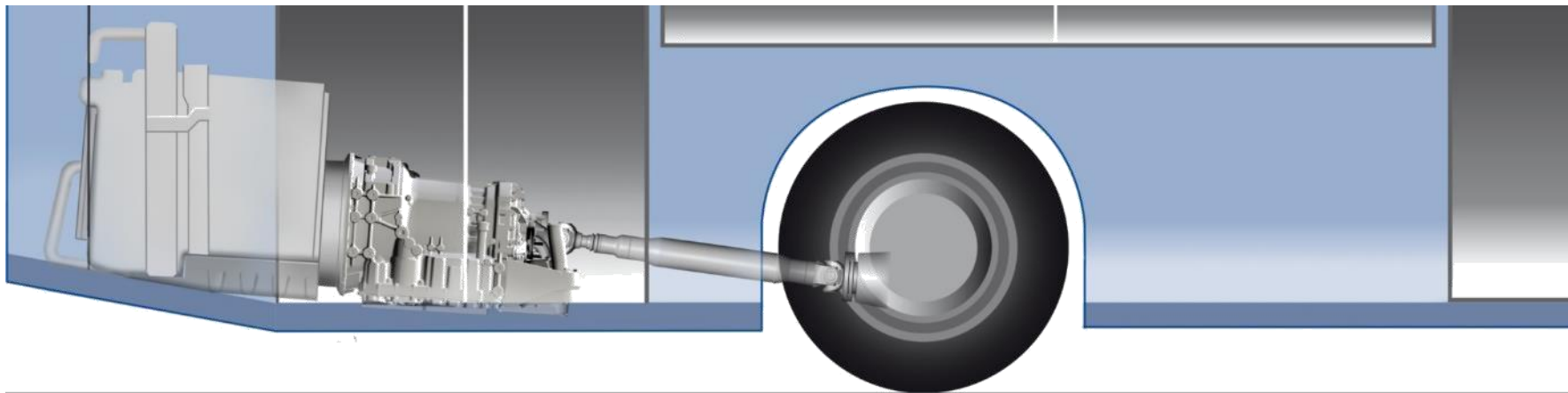
— Floor height in entrance area / center aisle

B Low-floor bus:



The BRT Driveline

Summary



The tasks of the BRT driveline:

Speed:

High average speed

Economy:

Reduced fuel consumption /
low life cycle cost

Comfort:

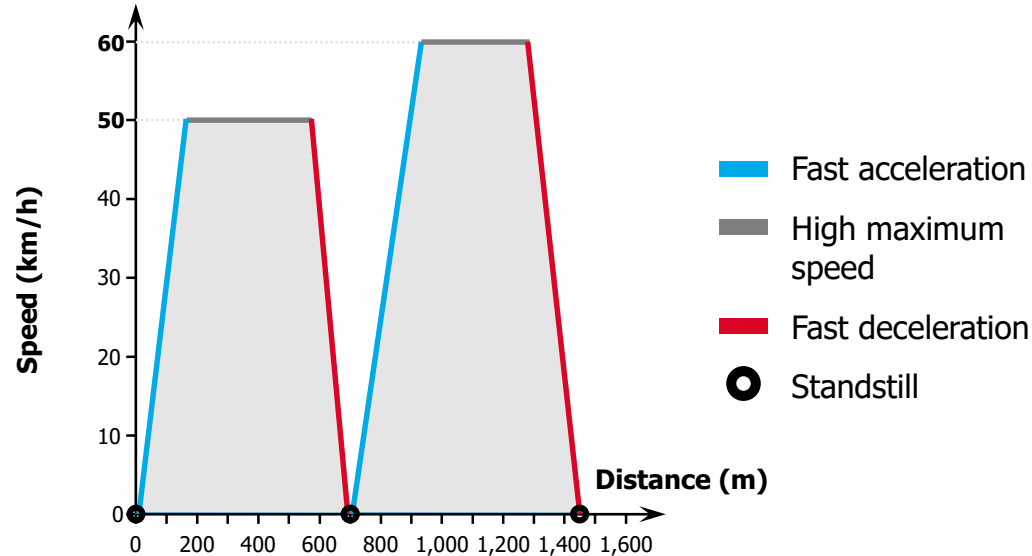
Smooth shifting and
braking / quiet operation

Ecology:

Low-emission

BRT Speed Profile

Typical BRT driving cycle with high average speed*

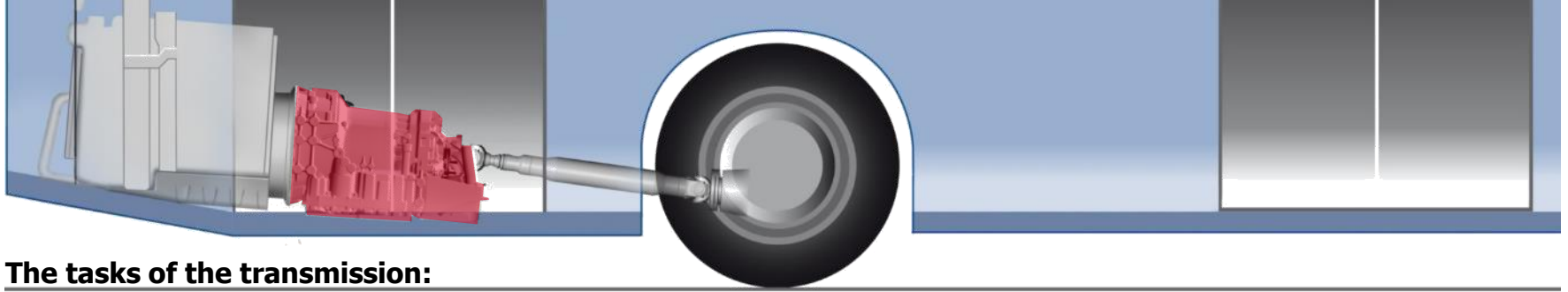


* here: similar to SORT 3 "Suburban", travel profiles depend on many factors beyond the implemented public transport network system. Travel profiles always need to be examined taking special, individual conditions into account.



ZF Transmission for the BRT Driveline

The most important driveline unit – the transmission.



The tasks of the transmission:

- Optimum use of engine performance in all driving cycle phases – **to meet all BRT** requirements:

High average speed

Reduced fuel consumption /
low life cycle cost

Smooth shifting and
braking / quiet operation

Low-emission



ZF-ECOLIFE

EcoLife – optimal for BRT

- Higher engine torques, up to 2,000 Nm
- More effective primary retarder
- More effective dual cooling system
- New control electronics with TopoDyn Life
- New torque converter, with torsional vibration damper as standard
- Longer service life, even with increased temperature requirements



ZF-ECOLIFE

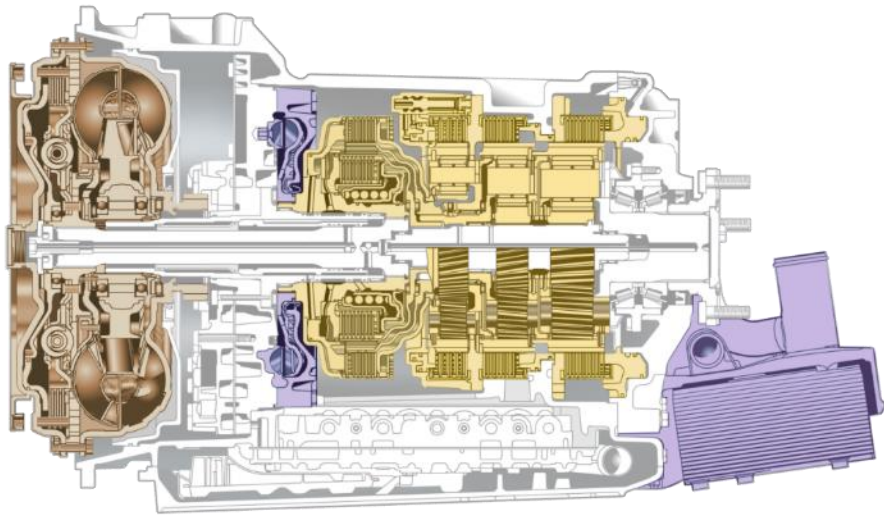
High average speed

Reduced fuel consumption / low life cycle cost

Smooth shifting and braking / quiet operation

Low-emission

All about EcoLife BRT Highlights



 Torque converter with lock-up clutch and torsional vibration damper

 6-speed planetary gearset and shifting components

 Primary retarder and dual cooling concept with separate retarder heat exchanger

 Control electronics with TopoDyn Life



Services

- ZF-Plus
- Openmatics
- Driveline consultancy
- Drive systems

EcoLife Highlights for High Average Speed

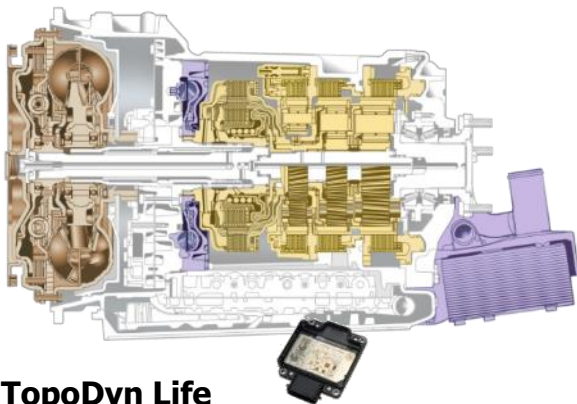
Best traction

- New torque converter characteristics**
for faster engine run-up and easy setting off
- 6 perfectly fine-tuned gears**
- 2 overdrive
- High spreading
for more traction in all speed ranges
- New shift elements**
for shortest shifting times

Fastest acceleration

Highest top speed

Strongest deceleration



TopoDyn Life

topographic and load-dependent adaptation of gear shifting points

Retarder adaptation

for higher shifting points on downhill gradients

- Primary retarder**
powerful at any speed, nearly down to a standstill
- Adapted braking performance**
depending on weight of the bus, use and driving situation
- Retarder fast filling**
for fastest response times
- Retarder heat exchanger**
for high cooling power and high level of retarder availability

EcoLife-Highlights for Best Cost-Effectiveness

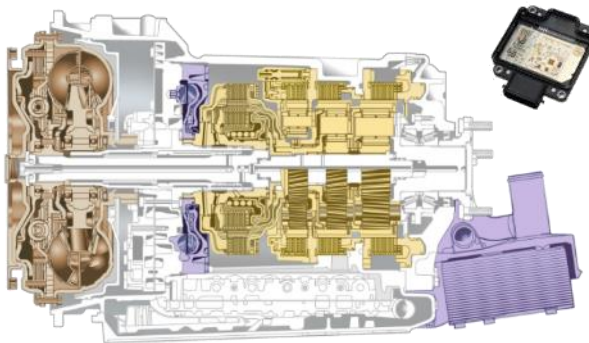
Lowest fuel consumption

Longest service life

Lowest LCC / maintenance costs

Very long service life of the brake pads

- **Very short torque converter phase**
for high mechanical driving percentage
- - **Early torque converter bypassing**
- **torsional vibration damper**
for lower shifting speeds
- **Large ratio range**
for low speeds, with high tractive force



- - **Little loss of torque**
- **New shifting elements**
for high efficiency

Retarder heat exchanger
for high retarder availability
and long oil change intervals

TopoDyn Life

topographic and load-dependent adaptation of gear shifting points

Retarder adaptation

for higher shifting points on downhill gradients

AIS (Automatic Idle Shift)

The transmission automatically shifts into neutral during standstill.

■ **Primary retarder**

high performance at all speeds for less brake wear

EcoLife-Highlights for Unsurpassed Comfort

Smooth ride

■ **Very short torque converter phase**

controlled bypassing
at low engine speeds

■ **Torsional vibration dampers**

for lower shifting speeds

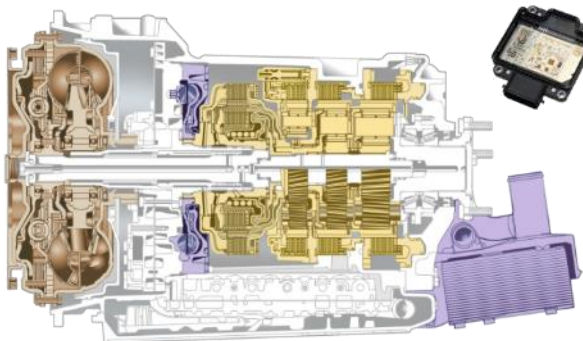
■ **- 6 perfectly fine-tuned gears**

- 2 overdrive gears

for low engine speeds when
accelerating

Lowest noise level

Gentle braking



■ **Shift elements continuously variable regulation**

for gentle gear shifts

■ **- Helical gearing**

Supreme safety

TopoDyn Life

optimum driving strategy for low
engine speeds

unchanging high shift quality

additional function to counter gear
hunting

■ **Primary retarder**

powerful at any speed, nearly
down to a standstill

■ **Continuously variable**

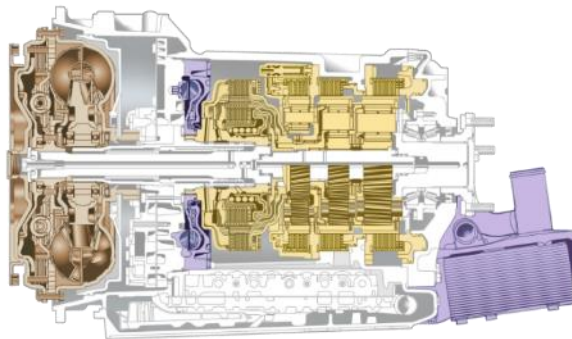
regulation of retarder braking
performance for high-precision
braking
in any driving situation

EcoLife – A Package of Benefits for the Environment

... for low
emission values

... for less
vehicle noise

... for minimum
brake abrasion



**High degree of efficiency and
high mechanical traveling
portions:**

-  very short converter phase
-  little loss of torque
-  new shifting elements
-  AIS

**Low engine and
shifting speeds:**

-  early torque converter
-  torsional vibration damper
-  large transmission ratio
-  TopoDyn Life

**High degree of retarder
availability and long oil change
intervals**

-  high-performance primary retarder in all gears
-  separate retarder heat exchanger
-  Ecofluid Life transmission fluid
-  retarder adaptation

References

Johannesburg, ZA

Beijing, CH

Istanbul, TR

Rhein-Neckar, DE

Santiago de Chile, CL

Curitiba, BR

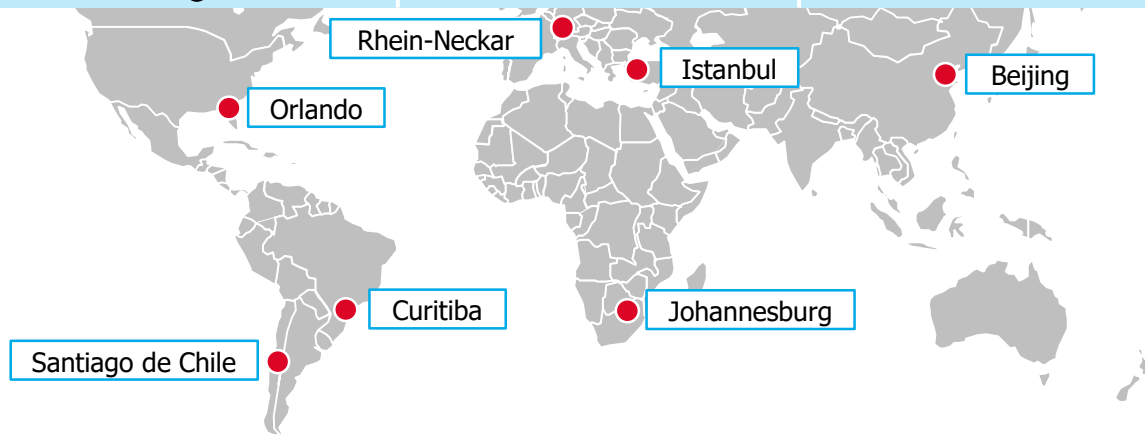
Orlando, US



ZF Powershift Transmissions in BRT Systems

Worldwide, proven in all BRT variants. Here are a some references:

City (Country)	BRT lite	Standard BRT	Full BRT
Johannesburg (South Africa)			○
Beijing (China)		○	
Rhine-Neckar-Verkehr GmbH (Germany)	○		
Istanbul (Turkey)			○
Curitiba (Brazil)			○
Santiago de Chile (Chile)			○
Orlando (USA)	○		

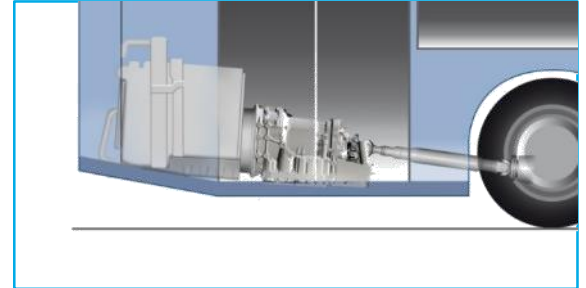


- More than 9,100 ZF transmissions used in BRT worldwide
- The relevant operating data allows effective BRT driveline consulting

+ Driveline Consulting Service +

With regard to new BRT drivelines, ZF transmission specialists will provide advice and support in the decision-making process:

- Selection of transmission and transmission design
- Selection of matching driven axle and axle configuration
- Fine tuning of the entire driveline



ZF Plus

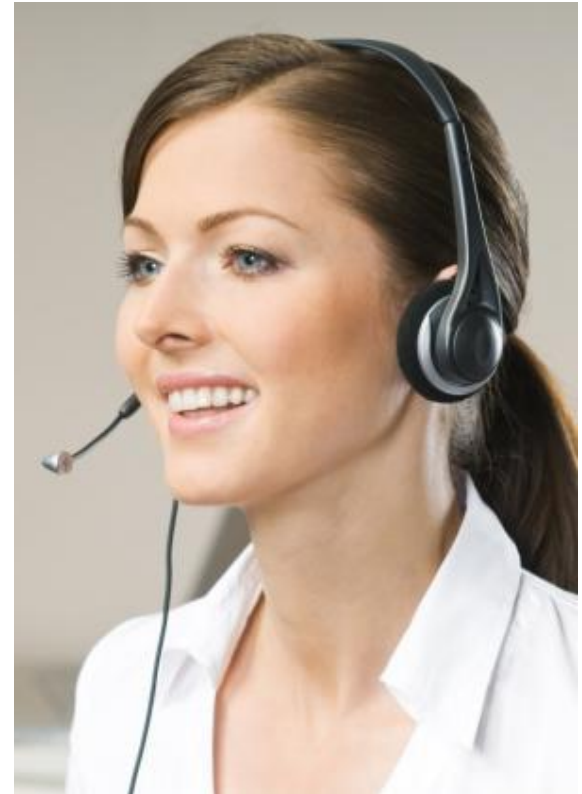
Long-Term Repair Contracts

Operating costs can be calculated.

Minimize the risk of operating, maintenance, and repair costs with long-term ZF service contracts:

- **Extended Coverage Program Bus**
(program covering repair-related risks)
- **Life Cycle Cost Coverage Program**
(program covering life-cycle costs)

Do not hesitate to ask the ZF Services for a firm offer!



Operating Data Evaluation EcoLife with Statistics Memory

The electronic control unit of EcoLife ...

- continuously checks the transmission,
- continuously logs operational data,
- is ready for data transfer via telemetric system (e. g. Openmatics)

Diagnosis and on-board data retrieval

- Remote diagnosis while bus is running
- Data can also be retrieved anytime via on-board interface (using ZF-Testman diagnosis software)

For optimum vehicle operation



Openmatics Telematics System

- Recording of latest transmission and operational data in the moving bus.
- **Evaluation in the Operations Control Center**
- Data transfer throughout the world

