Couplings, Clutches & Brakes

Overrunning Clutches

Formsprag Clutch • Marland Clutch • Stieber

STIEBER AND SVENDBORG BRAKES COMBINED THEIR EXPERTISE TO PROVIDE INTEGRATED SYSTEM

Altra® Couplings, Clutches & Brakes

W. Sullivan
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Outline of Paper

Paper's Outline in this Presentation:

- What are backstops and their use in material handling
- Example selection for overland belt
- Torque limiting backstops
- Multidisc brake allowing Release of backstop
- Suitable brakes and brake control modules
- Interaction of releasable backstop and brake module to assist in conveyor control

Background of Stieber and Svendborg

Altra Hierarchy and brands within Materials Handling

ALTRA

Altra Industrial Motion
The Power of Experience

ALTRA CCB

Altra Couplings, Clutches & Brakes

- Stieber

- Formpsrag

- Svendborg

- And many, many More

Industrial Clutch
Altra Industrial Motion
TB Wood's
Guardian Couplings
Altra Industrial Motion
Ameridrives
Twiflex
Altra Industrial Motion
Bibby Turboflex
Wichita Clutch
Altra Industrial Motion

Stieber Clutch

What is a backstop?

- A backstop allows rotation in one direction only.
- Overruns continuously during operation.

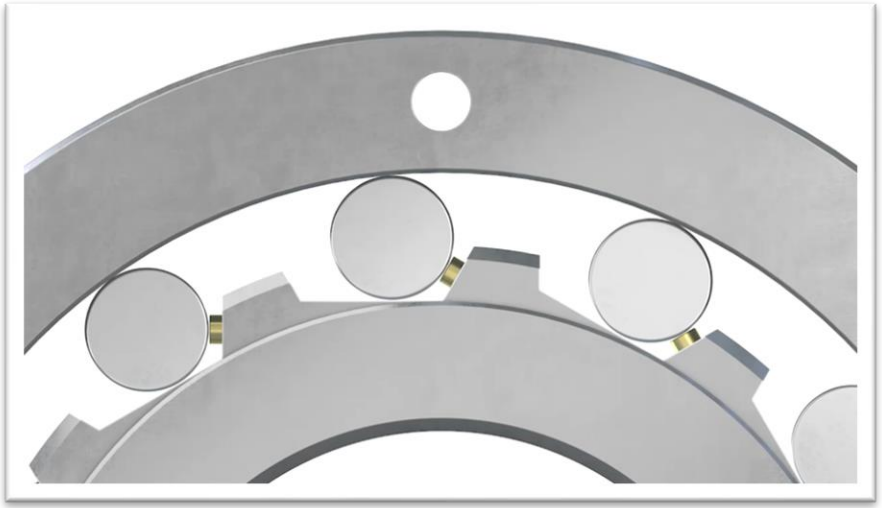
Typical Uses for Material Handling?

- Conveyors
- Bucket elevators

Backstops are used as Primary and/or Secondary safety device.

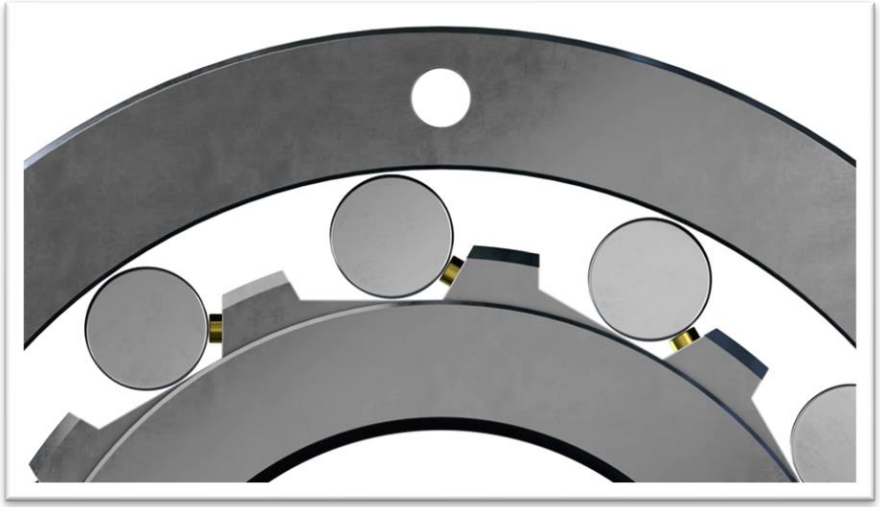
Overrunning Operation

- Inner race rotates
- outer race at standstill
- Roller running “downhill”



Backstopping Operation

- Inner race is blocked in opposite direction
- outer race at standstill
- Roller running “uphill”



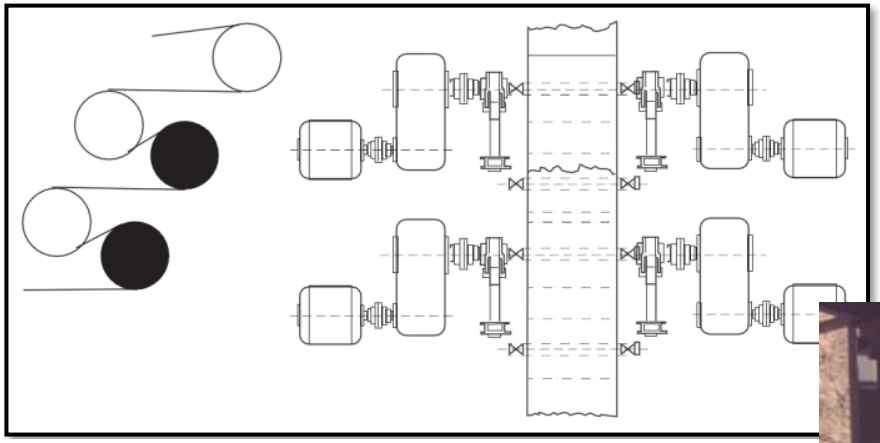
Backstop Location Options

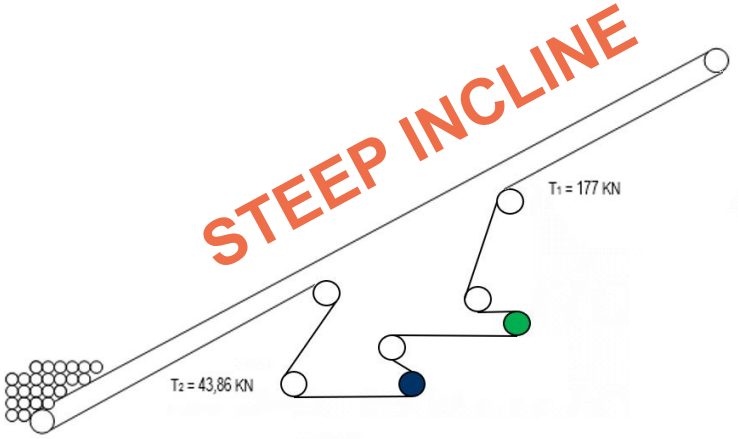
There are two different philosophies where to place the backstop:

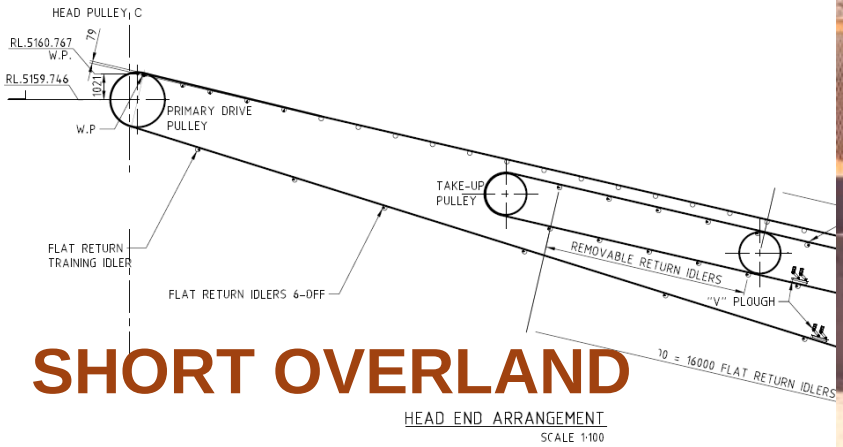
- on the pulley, or gearbox Shaft low-speed
- on the gearbox shaft high-speed

Backstop arrangement examples: Each one is unique

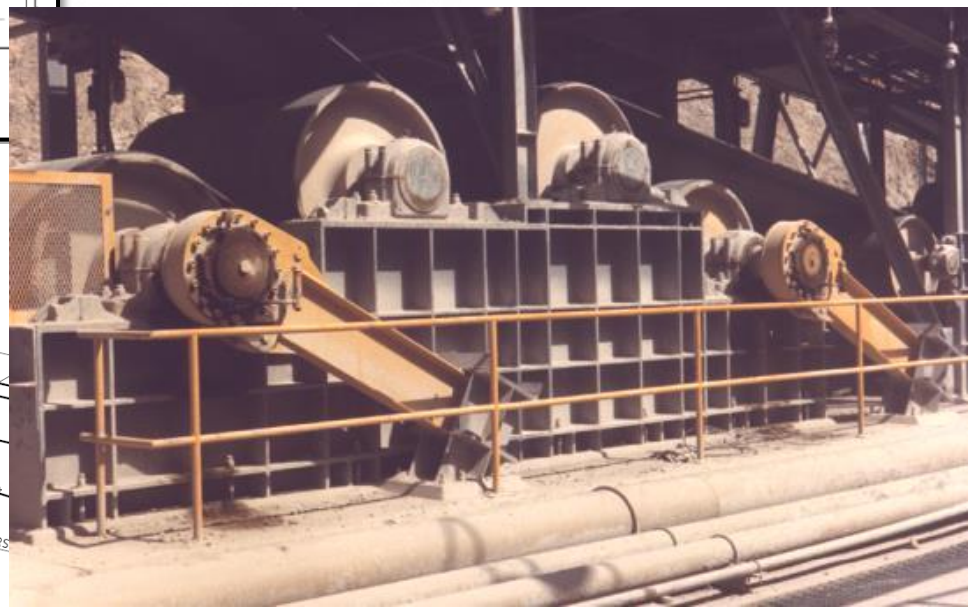
Quad Drive Overland







SHORT OVERLAND



Additional Backstop Selection considerations relating to backstops and brakes

#1 Conveyor geometry

Affects the power needed for Vertical and Horizontal movement

#2 Load Cases

How much runback or regeneration torque on the conveyor

 # 3 Belt Dynamics

What happens during various conveyor stop events

Consider for this discussion:
Long belt, low lift, interesting dynamics *(Overland conveyor)*

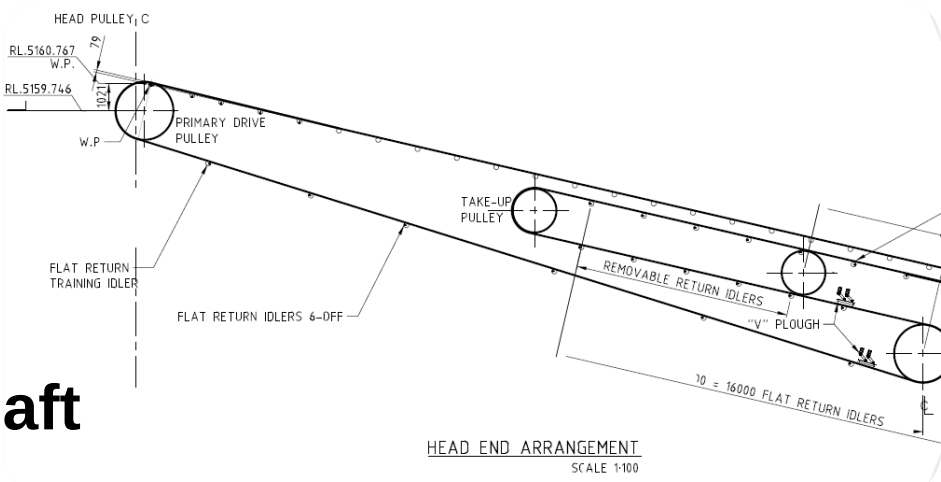
Selecting the right backstop for Example portal conveyor

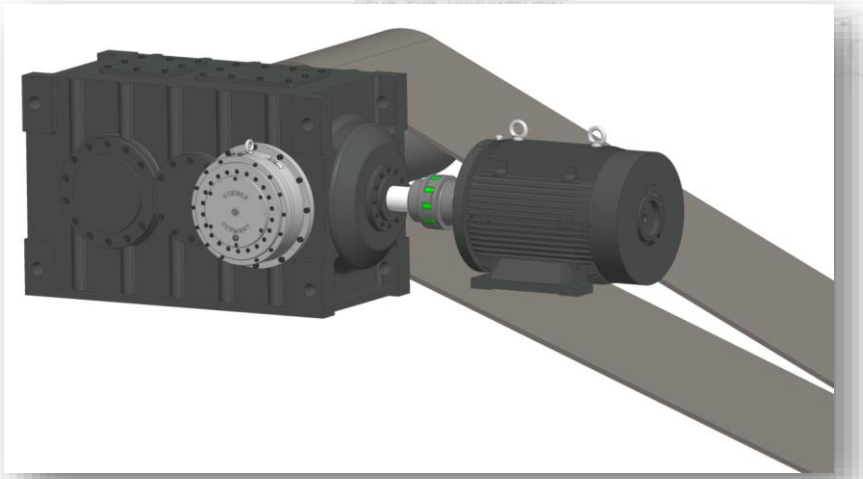
Installed power per backstop

- **950kW (1291 hp)**

- Backstop Mounting
  - **Gearbox High speed shaft**
- Backstop speed:
  - **500 RPM**
- Calculated runback torque

  Inclines Loaded
  - **15 kNm (11,000 ft.lbs)**





Backstop Selection Calculation:

Selection backstop based on **motor power**

– Drive torque limit 150% *(Australian Standard AS/NZS 4024)*

$$Torque\ (backstop) \geq \frac{950kW \times 150\% \times 9550}{500RPM} = \mathbf{27.2kNm}$$

So we select a standard backstop because:

– Robust design

– Good power density

– Widely known

Backstop Selection Calculation:

Selection backstop based on **motor power**

– Drive torque limit 150% *(Australian Standard AS/NZS 4024)*

$$Torque\ (backstop) \geq \frac{950kW \times 150\% \times 9550}{500RPM} = \mathbf{27.2kNm}$$

What happened on site:

Standard backstop (max. torque 72kNm) failed during interrupted startup with an overloaded belt.

A higher rating is not possible for the gearbox.

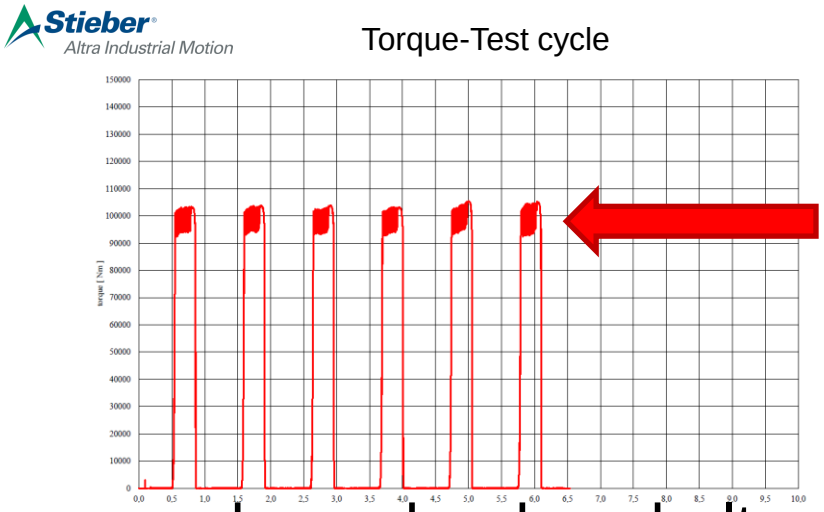
Selection backstop based on **Torque Limiting Backstop:**

– Torque Limiting Backstop service Factor 130%

$$Torque\ (torque\ limiting\ BS) \geq 15kNm \cdot 130\% = \mathbf{19,59kNm}$$

How does this affect the torque in the conveyor:

Slips when Torque exceeds a set value.
Protects the gearbox like a mechanical fuse. *The runback torque is still held!*



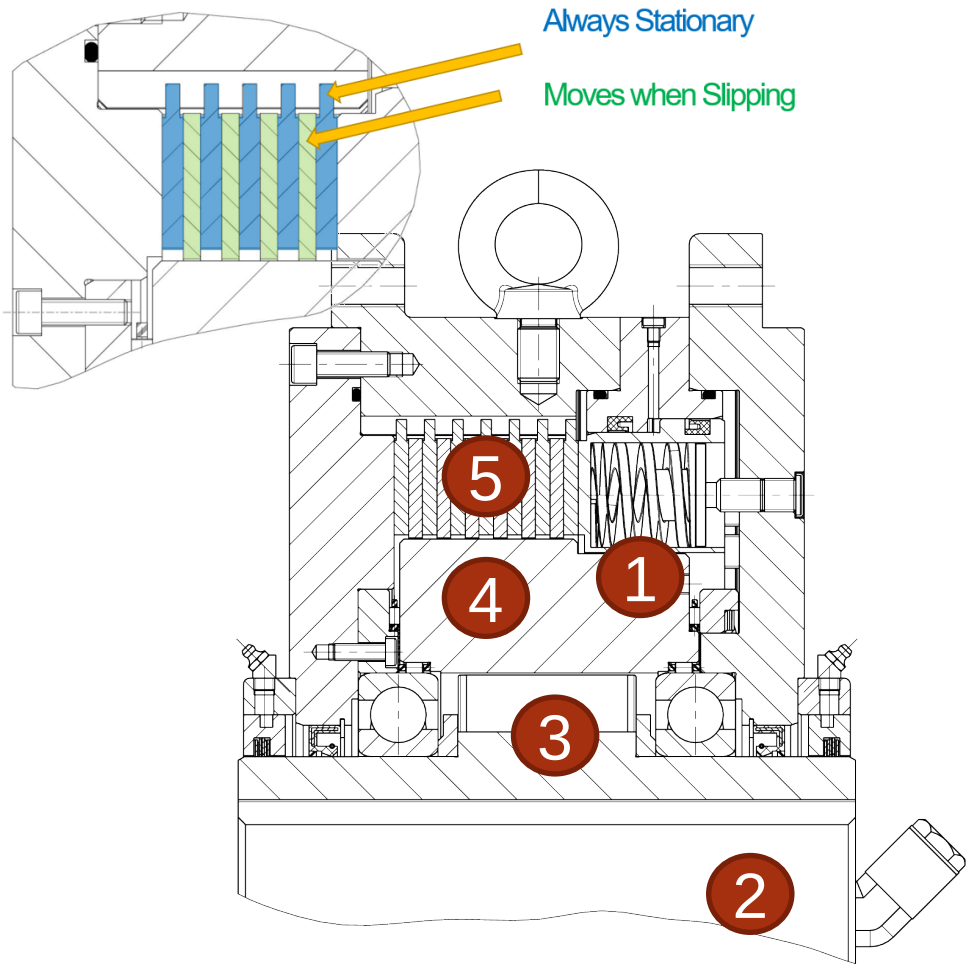
This allows protection due to torque peaks and reduce belt tension during:

- Aborted start-up & Emergency stop

Allowing:

- Downsizing of drive components
- Controlled load sharing

How does the Multidisc clutch work:



1) Springs apply force to to generate slipping torque.
2) Inner race ALWAYS connected to Pulley Shaft.
3) Clutch Mechanism that engage only when pulley is not being driven. *(Inner race overrunning clutch).*
4) Outer Race applies torque to Friction plates.
5) Multidisc brake slips when slipping torque is exceeded. *Slipping stops at set value 130% higher than runback torque.*

Other benefits of RDB Torque Limiting Backstops

–Higher torque capacity from wet Sintered multi-disc friction linings

– Robust and compact roller bearing support of the outer race for longer back driving life

– Optional Long life **hydraulic release mechanism**

(Note this requires a Hydraulic powerpack to be installed)

How backstops affect conveyor controls:

During some controlled braking events the backstop interacts with the conveyor, and this diminishes the control that the brake has on the conveyor

Passive Backstopping and Active braking may not be good for some conveyor belts

Tension oscillations occur in the belt which cause local backward rotation, which can affect the brake controller's ability to stop the belt as desired.

The cause is the different stiffness in the drive train depending on the direction of rotation. Now it gets technical.

Can a Releasable Torque Limiting be used to assist the conveyor brake controller?

Yes, if The clutch engagement is Quick and safe during release and re-engagement

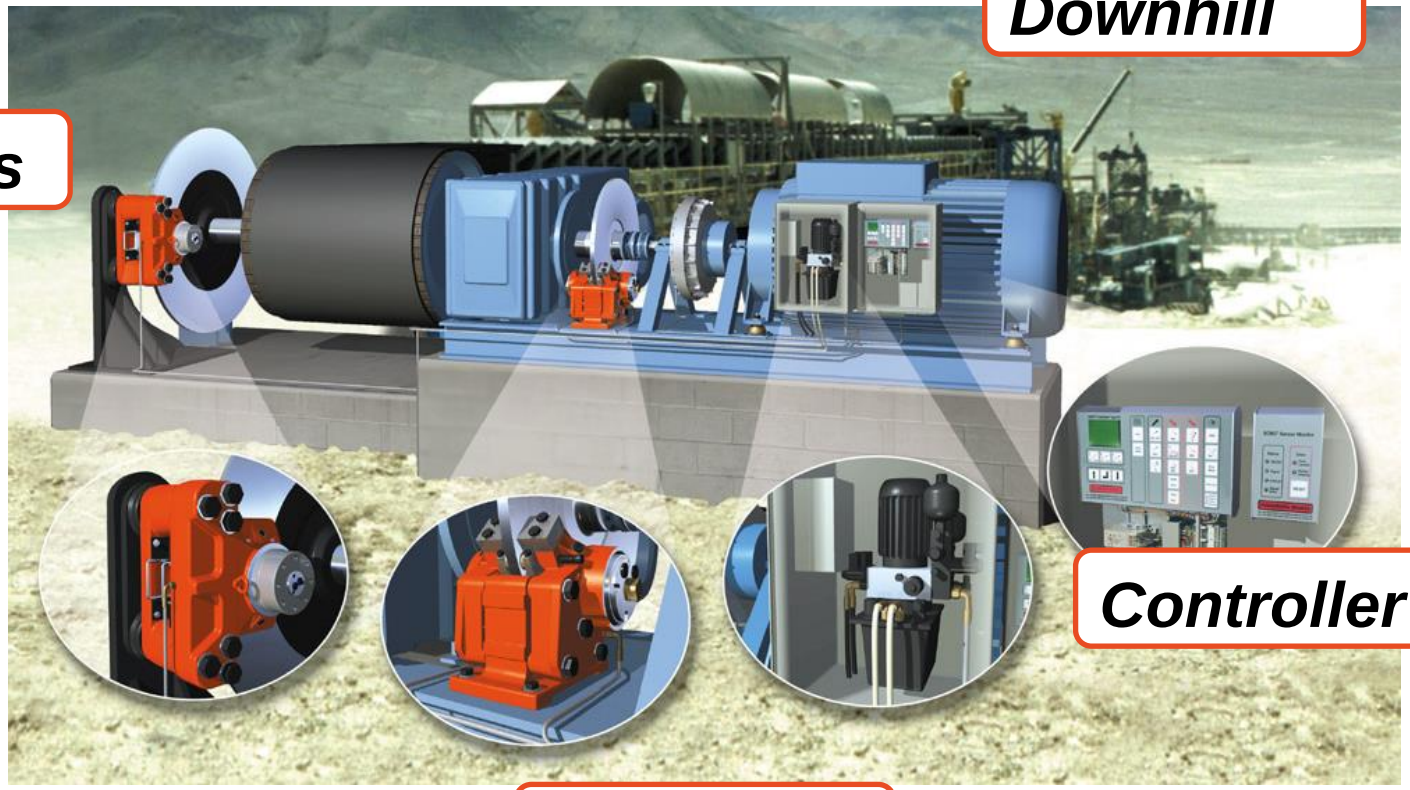
And if The brake and clutch units can be linked together

But only if The clutch can be used with existing power packs

Aaaand ***A suitable controller is available to control both the brake and clutch***

There already exists Controlled brakes that can control the release and reengagement of both the brake and additional devices. ***SVENDBORG SOBO IQ***

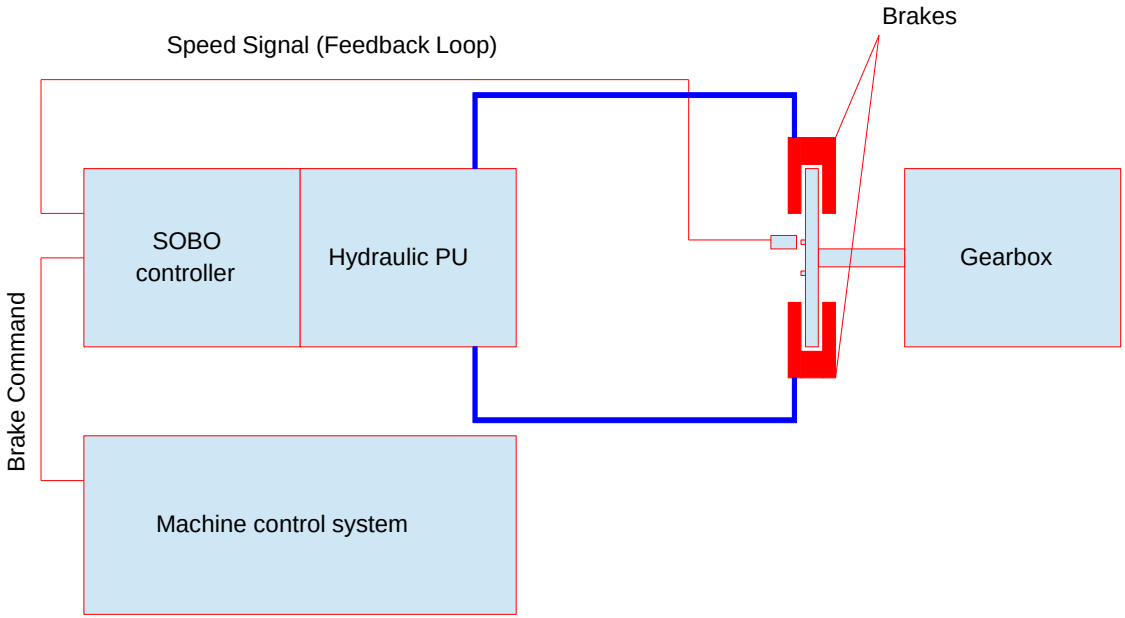
SVENDBORG has been supply controlled braking since 1990s for various conveyor applications



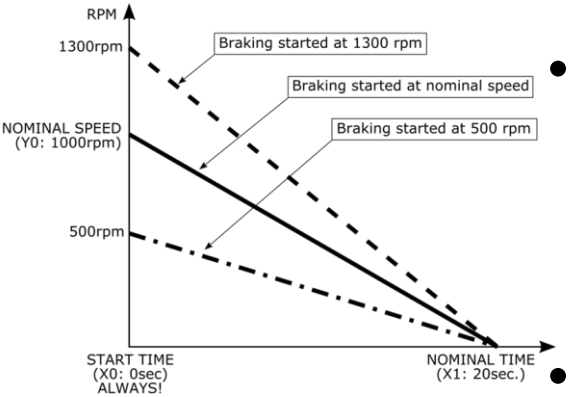
Feedback controlled torque brake controller - **SOBO**

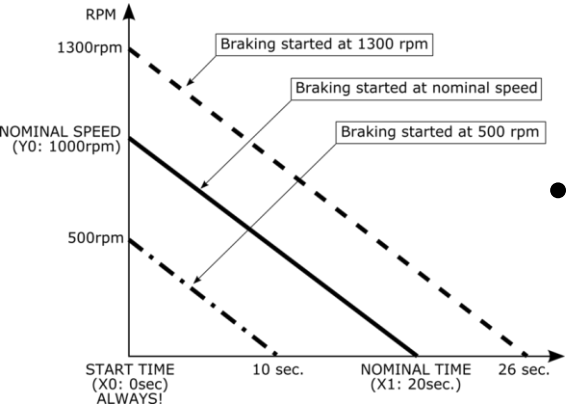
- SOBO – Soft Braking Option

  SOBO controls the brake torque based on a preset braking curve and actual speed input (closed loop feedback control



Soft Braking Option IQ – Programable version





- Designed around 2007 it is a Pressure-regulator with extra braking specific functions rolled into one controller
- Controls a hydraulic unit to regulate the clamping force of hydraulic brakes.
- Provides **Constant Time** / **Constant Deceleration** / **Constant Distance Braking**
- Invented and developed by SB

Does a conveyor need this?

The use of additional control will be determined by:

- Whether a backstop and brake are fitted on the same conveyor belt
- Dynamic Analysis

This solution can add the following benefits to new and existing conveyors:

- Reduction in stress during stopping events
- Improved service Life
- Improved operational reliability
- Improved effectiveness of control logic.

How can this be effectively be done to achieve **BRAKE and BACKSTOP** SYNERGY

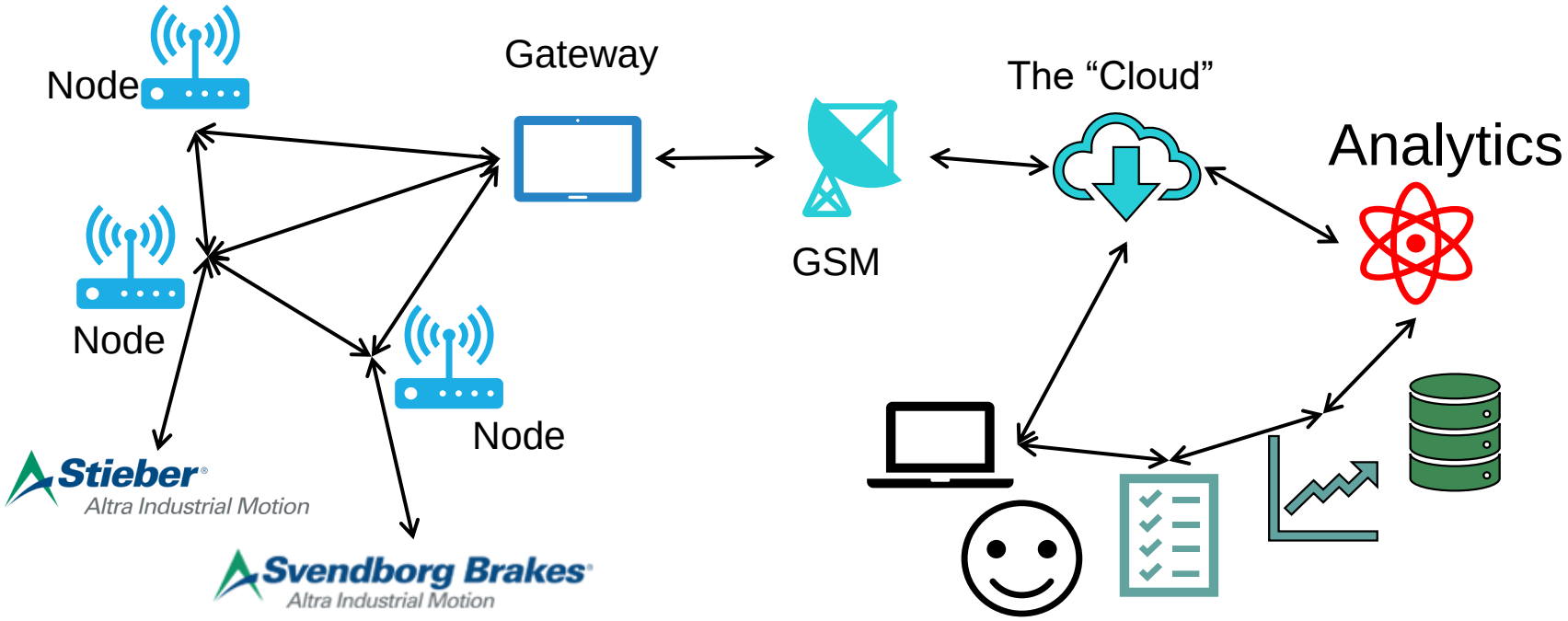
Communication between devices is critical for this type control.

BUT Brakes are typically at the TAIL and backstops are at the HEAD of the conveyor

The Clutch and SOBO need to be linked via:

- Cable connection
- Encrypted wireless communication

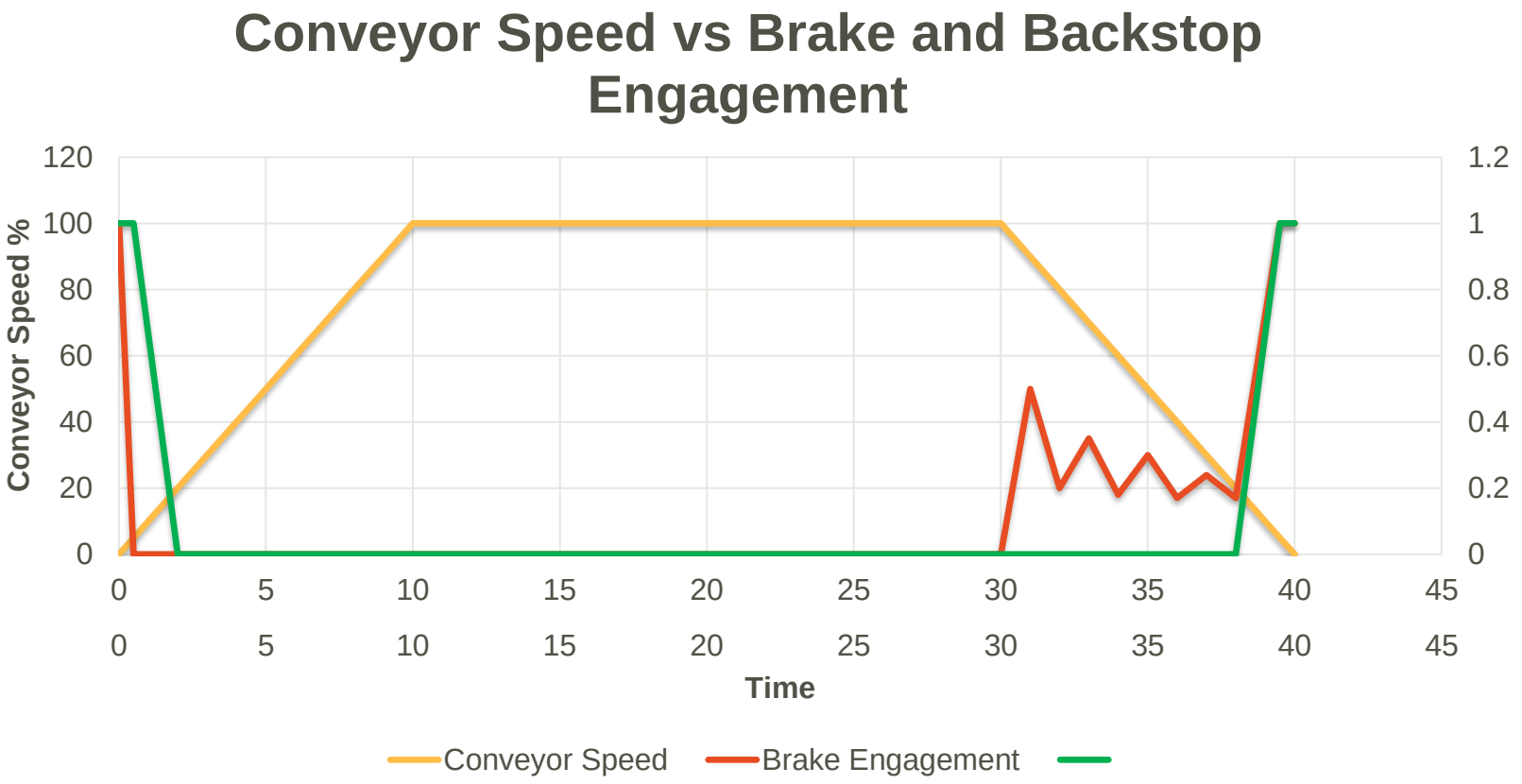
Altra IOT infrastructure



Allows:

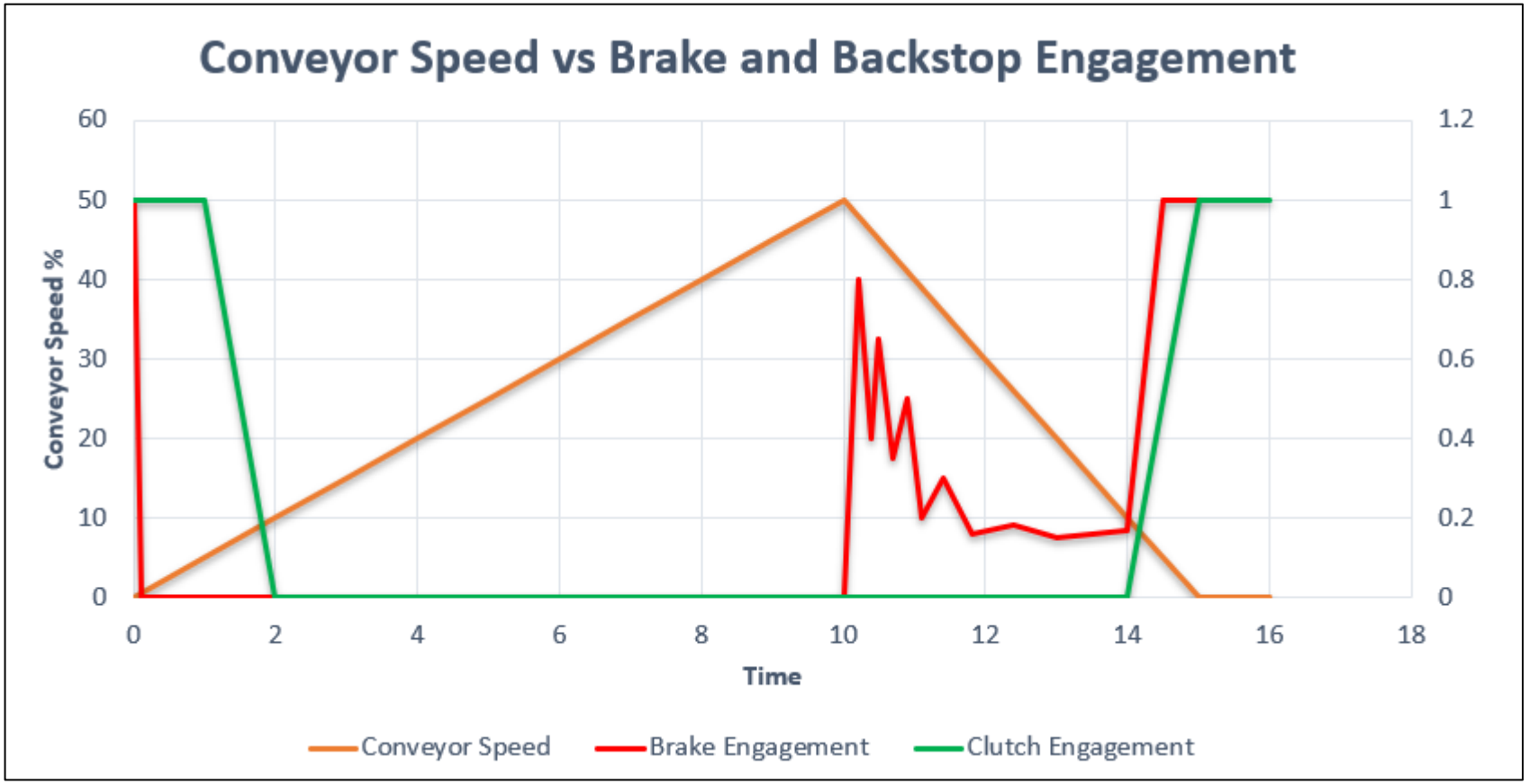
- Interactive communication between Nodes
- Encrypted signaling to devices, brakes and backstops
- Reporting and early detection of data

Controlled Example



Brakes and backstop control needs to de defined by dynamic analysis

Controlled Example – Aborted Start



Brakes and backstop control needs to de defined by dynamic analysis

For more information

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Thank you