ROLLON®
LinearEvolution

CASE STUDY

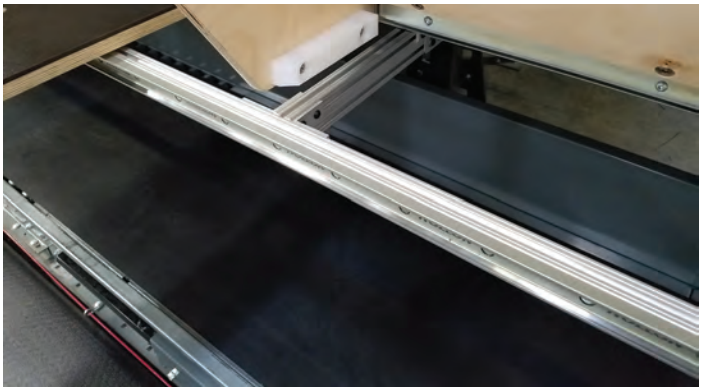
# SIMPLE SUPPORT STRUCTURE IMPROVES THE EFFICIENCY OF A WAREHOUSE PACKAGING MODULE

Automation is changing how traditional distribution centers operate as companies search for new ways to maximize their efficiency, increase order accuracy and fulfill customer demand. When it comes to automated technology, most people tend to think about robots, automated guide vehicles and pick-and-place systems. But just as important are the smaller, simpler structures that must be engineered to interface with the high-tech systems, and their designs present their own set of challenges.

Demonstrating this point, systems integrator N-III, Inc. recently devised a simple, yet large-scale solution to improve the efficiency of an existing warehouse packaging staging module. Though limited by challenging design constraints, the company created a supporting structure that mounts underneath the existing module and integrates an arrangement of plywood, aluminum extrusions and Rollon linear bearings, an achievement that required attention to ergonomics, ease of assembly and cost efficiency.

*Though limited by challenging design constraints, N-III created a supporting structure that mounts underneath a distribution center packaging module, integrating an arrangement of plywood, aluminum extrusions and Rollon linear bearings.*

**ENGINEERING CHALLENGES.** In this recent application, an automated package distribution center was looking to improve its packaging modules. Each module is made up of four chutes that feed packages from the top of the system down to the station operator. The operator is notified of an order and, from there, can pull it out, package it and place it onto a conveyor belt beneath the chutes. The customer wanted to incorporate support platforms onto the design of this existing structure, which the operators could utilize to box the finished orders.

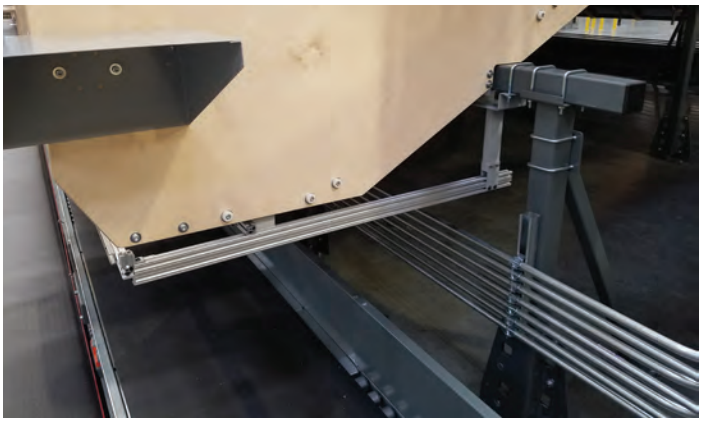


*The linear bearings used in the packaging module had to handle very high loads. A 150-pound package placed at the end of a table, for example, would create a 600-pound moment load on the supporting structure.*

A few solutions were initially proposed, including a scissor lift, drop shelf and a motorized, wheeled cart. However, all of these systems would operate apart from the existing module without having to mechanically interface with it. These ideas were ultimately scrapped because they were too costly or had ergonomic problems associated with them, requiring workers, for example, to twist, running the risk of injury.

N-III ended up solving these issues with a simple design that connects to the module and even uses its existing bolt holes. For a work surface, the engineers created tables made of strong ply, which they capped with an ABS plastic. These ABS "tops" were water jet cut and served as the template to rout the tables from the ply. The tables were then mounted onto a Rollon linear slider, which was mounted simply into a standard aluminum extrusion.

From there, workers can slide a table along the length of the chutes to where it is needed—a taping station, for example. While there is one table per four modules, tables can travel freely across up to 12 modules, maximizing design flexibility and minimizing the number of tables that need to be installed.



*N-III's solution added only four inches to the vertical space between the module and the conveyor underneath.*

**STRUCTURAL ENGINEERING REQUIRED.** The success of N-III's solution is owed, in part, to engineers' flexibility over the course of the design process. For example, it became apparent that the use of a 1 x 1-inch lateral bar would not be able to accommodate the moment loads created by the weight of the packages on the table-tops. A 100-pound package placed at the end of a table would create a 600-pound load on the supporting structure, pulling the bearing out of the rear track. To ensure that the system could hold up to these loads, engineers first ran a finite element analysis (FEA) test to analyze and compare system stress under loads using a 1 x 1 and 1 x 2 lateral bar. Whereas the 1 x 1 bar deflected, engineers discovered that the 1 x 2 bar could handle the high loads of the heavy packages. They therefore integrated this new component into their design.

**DESIGNED FOR ASSEMBLY.** N-III's solution overcame several design constraints, all of which were dictated by the existing packaging structure. For one, engineers had to figure out a way to attach the tables to the structure without any additional drilling or the use of T-nuts. Besides being more expensive than the aluminum sliders themselves, logistically, incorporating T-nuts would have been a design nightmare. Instead, the engineers designed pre-drilled and tapped bars that, once inserted into the extrusions, readily aligned with the track's 4,000 existing bolt holes.

It was also important that the design maintain a certain height so as not to impede the conveyor belt beneath the staging module once it was attached. N-III's solution added only four inches to the vertical space between the module and the conveyor underneath.

## ROLLON COMPACT RAIL COMBATS MISALIGNMENT

Bearings that aren't aligned properly during installation can cause problems on any precision machine, resulting in wear or even reduced bearing life. The Rollon Compact Rail system is inherently tolerant of misalignment, thanks to a rail geometry that can absorb alignment errors in one or two axes. Whereas ultra-high precision guides measure acceptable misalignment in arc minutes and microns, the Compact Rail measures it in degrees and millimeters. For example, Compact Rail rollers can rotate up to 2 degrees relative to the rail without affecting functionality or increasing wear. For machine builders, having a self-aligning system results in greater design freedom and cost reduction. Simple spacing tools make installing to the proper tolerance easy.

*The packaging module includes tables, which are made of strong ply and are capped with an ABS plastic. The tables were mounted onto a Rollon linear guide, which was inserted into a standard aluminum extrusion.*

**COST SAVINGS.** Additionally, unlike the motorized, wheeled cart originally proposed, N-III's final design included no complex moving parts. It integrated a simple, space-efficient structure that could be attached to the existing staging module, using the structural members, bolt holes and brackets from the existing the structure for seamless integration—reducing overall implementation costs by 40 percent.