

Design & Vision

Making the Process Fit the Market

“THE VERSATILITY OF THE ROTATIONAL MOLDING PROCESS IS UNMATCHED BY ANY OTHER PLASTICS MOLDING PROCESS.”

The versatility of rotational molding is unmatched by any other plastics molding process because of its wide range of applications, part sizes, levels of productivity and investment requirements. One can become a rotational molder with a minimal investment by building a simple open flame hand cranked machine to mold tanks in sheet metal molds, or invest hundreds of thousands of dollars in automated computer controlled machines, molding complex parts in multiple cast aluminum molds. In industrialized countries within North America, Europe and Australia, rotational molding is expanding into a wide range of markets other than its traditional one, tanks. Molders and mold makers are seeking more profitable markets with a competitive edge. These sophisticated applications require higher investments in equipment, materials, molds and designs.



Despite these trends however, the majority of rotationally molded parts are still tanks. This is especially true in economically developing countries within South America, Africa and Asia where the demand for cost effective water storage tanks is almost unlimited, comprising more than 90% of the market. (Photo 1a & 1b) However molders and resin suppliers in these regions are beginning to recognize the unmatched versatility of rotational molding. Their



Photo 1a: Water Storage Tanks

awareness is being stimulated by publications such as this magazine and information being made available through trade associations such as ARM



Photo 1b: Water Storage Tank

attendees were introduced to the state of the art. Current trends in processing, design and applications for rotational molding provided the group with a glimpse of what is being done throughout the world. This article will highlight innovative applications developed in Europe and North America as well as potential applications unique to India.

Rotational molding is perfectly matched to India's needs because of its wide latitude of investment, manufacturing and design options offered by the process. These characteristics parallel India's unique extremes in wealth, education,

dialects. These diverse and complex extremes represent a country with a 7000 year history and rapidly changing economy poised for the 21st century. With a population of more than 3.5 times the US in an area slightly greater than 1/3 the US (1,065,070,607 people in 1,269,338 sq mi), India's market opportunities are daunting. (Photo 2)

Rotational molding has successfully expanded into numerous markets within industrialized nations due to a combination of technological advancements and competition. Although many of these innovations have gradually evolved from spiraling advancements in processing machinery, molds and materials, growth spurts have typically originated with visionary individuals. People who have applied this process to the right application, at the right time and with a good design have opened new market opportunities and become wealthy. These markets have included toys, containers, kayaks, furniture and material handling applications which now account for the majority of US and European rotational molding applications. (Figure 1) (Photo 4)

As a matter of fact, the annual number of new applications for rotational

ROTATIONAL MOLDING IS IDEALLY SUITED FOR INDIA AND OTHER DEVELOPING NATIONS.

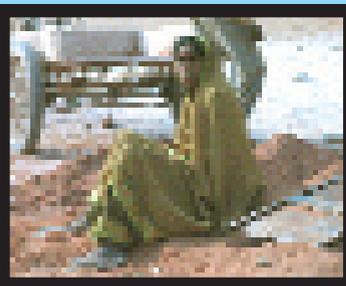


Photo 2: India Culture and Tradition

International, ARMO and the SPE.

An example of how this technology is being distributed throughout the world is represented by ARM International's recent conference in India. Throughout this two week period the first part of December 2004, more than 200

technology, transportation and market requirements. India has a wide range of climates, population densities and religions. Although English and Hindi are the national languages, India has more than twenty-eight distinct languages spoken and more than 200 different

molding has continually splintered traditional markets into new segments at an unprecedented rate during the past eight years. Most of the progress has occurred in industrialized countries because of market saturation and pricing pressures placed on molders. Saturated

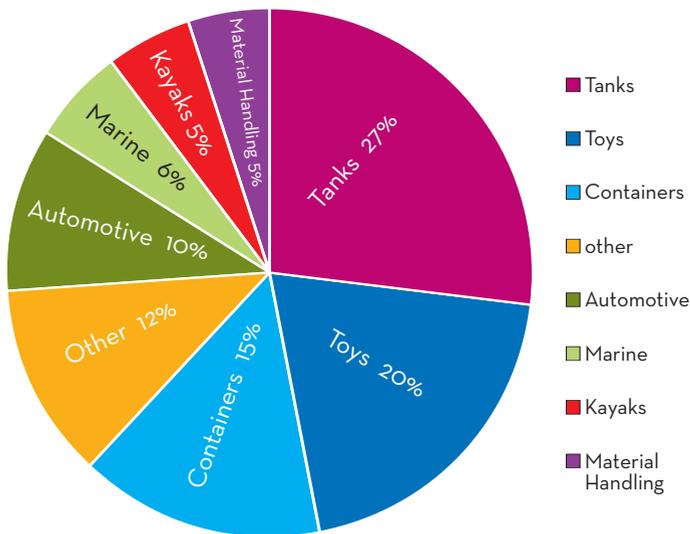


Figure 1, Information Reference from Dr. Peter Mooney, Custom Plastics Research

markets have forced prices to drop providing an incentive for manufacturers to seek improved manufacturing efficiency, mold quality, material selection and design. These improvements have also stimulated ideas for new applications that have not previously been considered as viable for rotational molding. Trends toward improved productivity and sophisticated applications have raised the required investments for this process.

Will economically developing countries like India have to wait decades

India will change much faster. Rotational molding is ideally suited for India and other developing nations. The versatility of the process provides one the choice of entering the business with a minimal investment to mold tanks or a higher investment to mold more profitable specialty products. This article will present how rotational molding can benefit countries such as India based applications unique to its culture.

India is currently going through a period of rapid economic expansion. Its large labor force and democratic

country's insatiable need for affordable housing, transportation, sanitation, education, food and clothing provide a huge market for goods and services. These basic needs provide opportunities for distinctively Indian products that are ideally suited for rotational molding.

The first of these would be a bicycle powered rickshaw. (Photo 5) Although rickshaws are seen in other parts of the world, India has a variety of bicycle powered rickshaws that are used to transport people and all types of materials. Many of these vehicles are distinctively decorated, inexpensive and light weight. Some of the requirements for a passenger rickshaw other than those previously cited are listed below:

- It should be easy to enter and exit
- It should be durable
- It should be colorful and easily decorated
- It should be easily assembled to a bicycle
- It should be easily customized
- It should be comfortable
- It should accommodate two people
- It should be capable of storing personal belongings
- It should resemble traditional rickshaws

ROTATIONAL MOLDING HAS EXPANDED INTO NUMEROUS MARKETS WITHIN INDUSTRIALIZED NATIONS.



Photo 4: Typical Design Applications

before rotational molding finds its place in applications other than tanks? The answer is emphatically no. Unlike industrialized countries that have taken more than forty years to apply rotational molding to applications other than tanks,

capitalist economy are strategically positioned to compete with China as the world's next dominant manufacturing country. However, unlike China, India might consume most of what it produces by its population of 1.1 billion. The

As one can see from the pictures, India's rickshaws have a minimal structure. They are typically constructed from a combination of aluminum tube and sheet. A soft cushion is added to the seat for passenger comfort. Frequently

drivers decorate the exterior with colorfully ornate patterns for aesthetic purposes as well as easy identification. A retractable canopy is sometimes included to provide shade or protection from rain. The sides of the passenger compartment are free from any obstructions to provide easy entry and exit.

What benefits could a rotationally molded passenger compartment offer versus the current materials and manufacturing methods? A rotationally molded compartment would offer many advantages, some of which are listed below:

- Less expensive

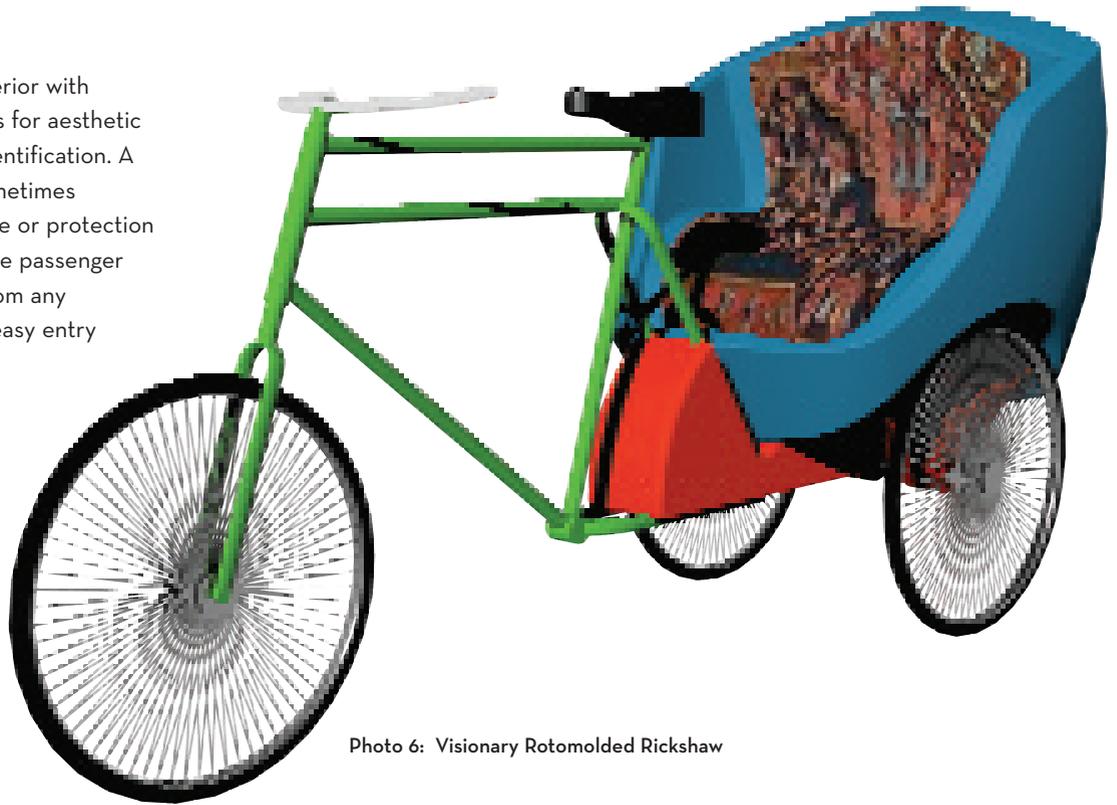


Photo 6: Visionary Rotomolded Rickshaw



Photo 5: Bicycle Powered Rickshaw in India

A ROTOMOLDED RICKSHAW OFFERS MANY ADVANTAGES.

- Aesthetically more attractive
- Lighter weight
- More durable
- Less parts
- Molded in color
- More functional
- Easier to assemble
- More comfortable

The concept in Photo 6 represents just one example how a rotationally molded rickshaw could be designed. This concept is based on a two-piece structure including a passenger compartment and a chassis. Rotational molding would provide an opportunity to

cost effectively attain styling freedoms similar to those in automobiles. Polyethylene with molded in colors would eliminate concerns for chipping, denting and corrosion. High strength to weight ratios achieved with proper design and material selection would yield a very rigid structure capable of withstanding stresses induced by rough roads. Advantages of maintaining bicycle wheels as part of the cab are their light weight, low cost and popularity. The one piece cab would be much stronger than the welded sheet metal cabs which usually fail at weld joints. Structural integrity would be achieved by

integrating the overall form with proper reinforcements such as kiss-offs on the underside of the cab. (Photo 7) A rotationally molded one-piece chassis would also provide added benefits of simplifying assembly to a bicycle frame and eliminating concerns for corrosion. Features for mounting wheels and providing a storage compartment could also be easily included within this module. Contrasting color combinations can be applied for another level of design individuality. Features for easily mounting the chassis to the cab body would enable the compartment to be shipped assembled or separately to the

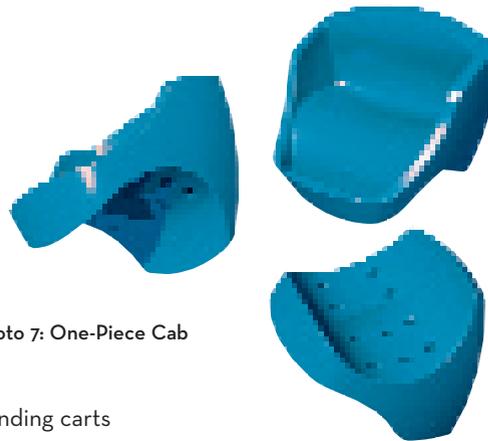
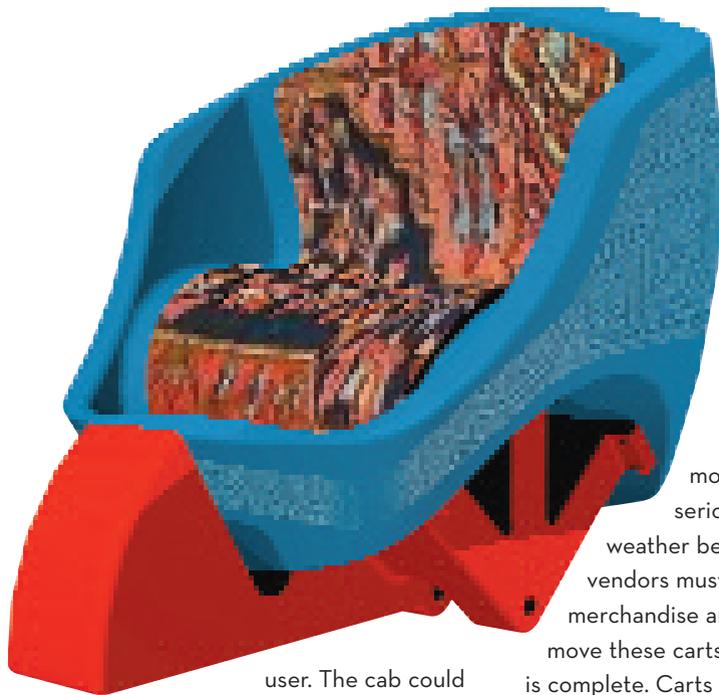


Photo 7: One-Piece Cab

user. The cab could also include features to accept a soft cushion, drain holes and mounting holes for optional canopies. Exterior surfaces could be decorated with traditional ornate Indian textures or molded in graphics for uniquely

most vending carts seriously deteriorated and weather beaten. However, vendors must still display their merchandise and be able to easily move these carts after their work day is complete. Carts must be sturdy and affordable since vendors have limited financial resources. Although a rotationally molded vending cart might not be readily affordable to everyone, it could be a viable alternative for a percentage of vendors if it offered

specific advantages. Some of these advantages and design possibilities are listed below:

- Provide a means of attractively displaying merchandise
- Offer an extended life versus wood
- Attract more customers based on colors and overall design
- Provide security with closed compartments



Photo 8: Traditional Indian textures that can be incorporated into rotomolded parts.

A ROTOMOLDED VENDING CART COULD OFFER SPECIFIC ADVANTAGES.

individualize cabs. (Photo 7)

If one were to travel through a city or drive through any countryside within India, one would immediately notice a common sight, the street vendor. There are millions of street vendors throughout India selling everything from apples to clothing from their transportable vending carts. Almost all these carts are constructed in a similar manner based on an upper wooden deck and a lower steel chassis supporting four bicycle wheels. (Photo 9). It is not uncommon to see

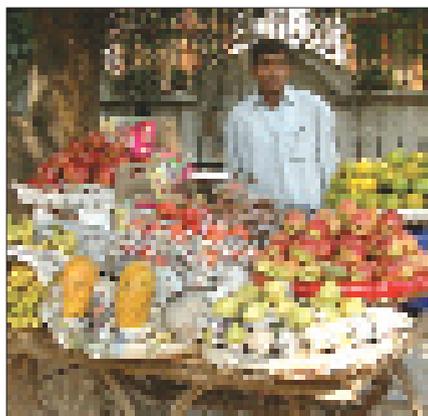


Photo 9: Traditional Vending Cart



Photo 10: Rotationally Molded Vending Cart

- Be more easily transported and set up
- Be lighter weight
- Store more merchandise
- Be easily upgraded or custom configured
- Options for thermal insulation for cold storage

Photo 10 shows a concept for a multicolored, modular, rotationally molded fruit vending cart. This concept is based on an interchangeable set of modules that can be configured to satisfy any number of custom user requirements. The red base unit is designed as a one-piece rotationally



Photo 11: Base Module

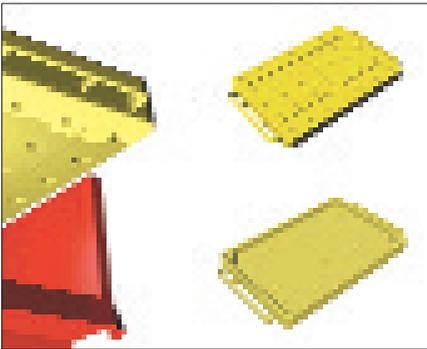
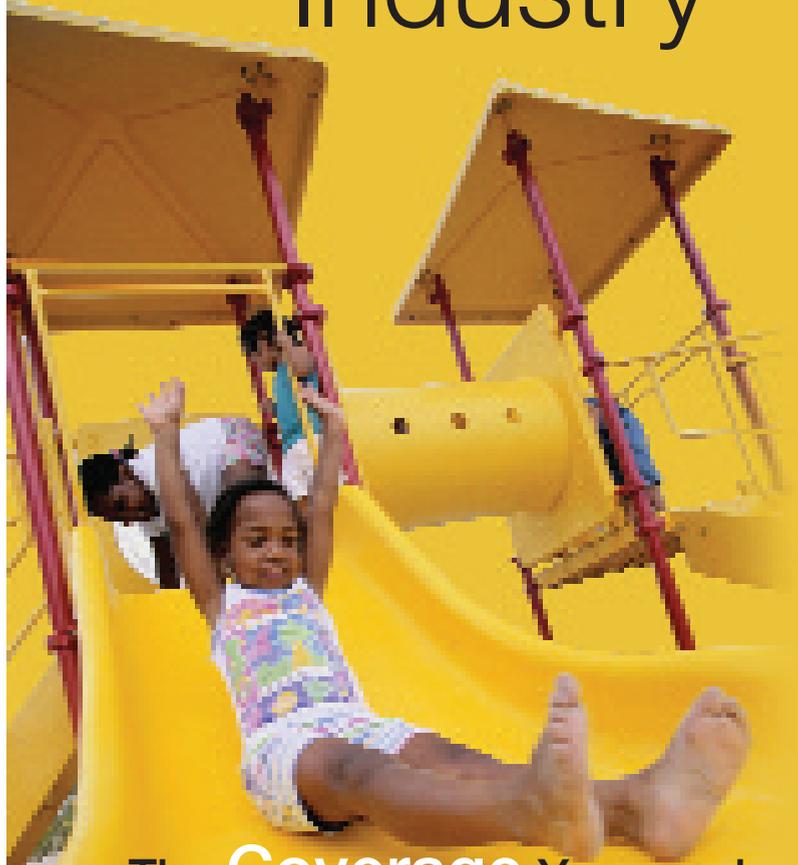


Photo 12: Deck Piece

molded chamber which also acts as a chassis. Bicycle wheels which are traditionally used in vending carts can be attached to the base module and protected by the integrally molded in wheel fenders. Photo 11 Integrally molded in hinge knuckles within the main body and doors provide a structurally robust hinge that would be virtually impossible to break. Pad locked hinged

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Photo 13: Food Cart and Rotomolded Roof

doors would permit vendors to store valuable merchandise within secure compartments in the main base. If the spaces between double walled doors and the main body are filled with



Photo 14: Traditional Classroom Furniture

polyurethane foam, thermal insulation could be introduced. These compartments might then be used for ice cream or chilled beverages.

A yellow foamed polyethylene deck could be sold separately or as part of

the system. (Photo 12) Features such as shut-offs and recesses to align the lower main chamber have been included for additional stiffness as well as ease of assembly. Displayed merchandise is



Photo 15: Rotomolded Classroom Desks

improved by adding a foldable rack with features to accept a number of optional tiers. These tiers permit fruits to be displayed without damage.

After a day's work, emptied racks can be folded and stored away on the

main deck.

An optional rotationally molded roof mounted on four steel posts would shield merchandise from sun and rain. The system could be also be expanded to include modular panels between the roof and deck for added security or display surfaces. Another configuration would include a lower cost system sold without the rotationally molded roof, which would be substituted with a cloth canopy provided by the end user. (Photo 13)

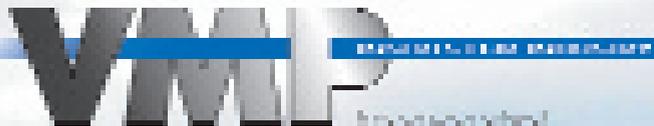
One of India's most valuable resources is its children, who hold the future in their hearts and minds. Their success as adults and India's destiny will depend on the quality of their education. Today, many of India's schools lack proper facilities including furniture to adequately satisfy the needs of their hundreds of millions of students. Most of India's classroom furniture consists of a simple desk and two chairs for each pair of students. Designs are very basic, drab and uncomfortable because of their painted wood construction. (Photo 14) Wooden furniture tends to chip, restricting designs to simple shapes that can be very uncomfortable and have a



Photo 16: Rotomolded Classroom Chairs

limited life within environments of highly active young children.

Rotationally molded classroom furniture could cost effectively replace wood with colorful, long lasting tables and chairs. Tables would no longer have



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to consist of a wooden slab fastened to four legs. Instead, table surfaces could be designed with softer edges and shapes. They could include storage compartments for books, papers and pens. Desks could be designed with four detachable legs for compact shipping. (Photo 15) Chairs would be designed for comfort with ergonomically contoured backs and seats mounted to a separate base for easy shipping. (Photo 16) Playful colors can be molded as an integral part of the seat to add to enhance the

atmosphere of a cheerful learning environment. Chair bases could provide a swivel and tilt feature for added comfort. Rotationally molded furniture would provide a longer life cycle than wood. They would be lighter, chip resistant and very durable. Splinters, broken joints and sanitary problems associated with wood are nonexistent with rotationally molded polyethylene furniture. Rigidity and flatness of the table surface would be optimized with foamed polyethylene. Granite colors can

be specified to enhance appearance and the surface texture of desks. (Photo 17)

Rotational molding doesn't have to be limited to portable products. It can be also be used to create parts for permanent architectural structures such as bus stops. Many times the most obvious applications for rotational molding go unnoticed during our daily lives. Bus stop stands of every type are located on thousands of streets throughout India. They are used by millions of people each day who are



Photo 18: Traditional Bus Stop Stands in India

ROTOMOLDING CAN BE USED TO CREATE PARTS FOR PERMANENT ARCHITECTURAL STRUCTURES.



Photo 17: Rotomolded Desk and Chairs

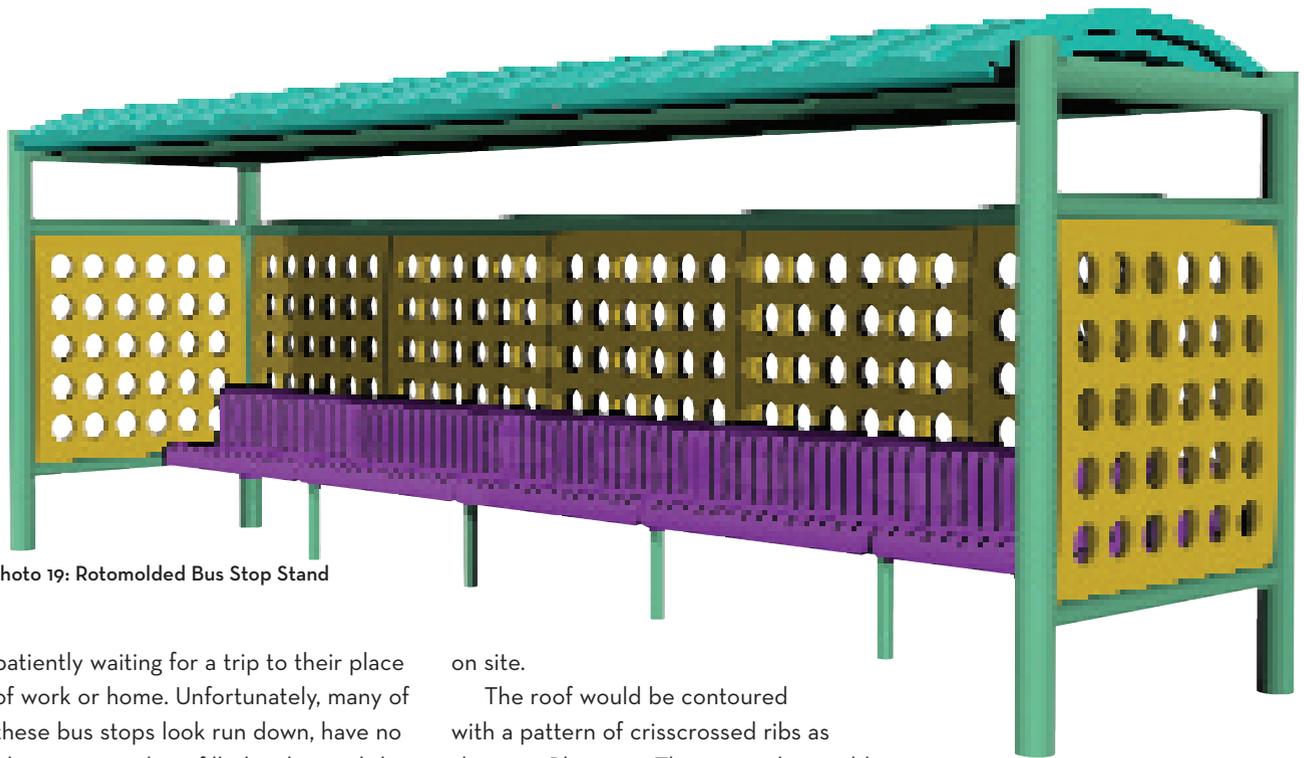


Photo 19: Rotomolded Bus Stop Stand

patiently waiting for a trip to their place of work or home. Unfortunately, many of these bus stops look run down, have no place to sit and are filled with unsightly graffiti. (Photo 18) Bus stops, like most architectural structures express the culture in which they exist. Some are frivolous, others classic and many are very functional. India's architecture is represented by a variety of colors, forms and styles based on its many

on site.

The roof would be contoured with a pattern of crisscrossed ribs as shown in Photo 20. The outer ribs would enhance water drainage while the perpendicular ribs on the underside kiss-off to the outer ribs forming a very rigid roof. Attachment points on the underside would permit roof panels to be mounted to the superstructure. Alternating lap joints on the ends of roof

openings in the surrounding walls adds rigidity to panels as well as providing a spacious perception for awaiting passengers. Open walls also deter application of graffiti to surfaces. A variety of specific color combinations and traditionally ornate Indian motifs could be substituted for a more obvious expression of Indian culture. After the structure has been erected, wall and roof panels would be quickly assembled, followed by benches. The result would be a cost effective dramatic departure from conventional bus stops used today. Advertising and other information could be restricted to specific areas by placing rotationally molded panels along the top or within limited regions on walls.

These are only a few applications that demonstrate the versatility of rotational molding and its potential applications within emerging economies in countries like India. It is the author's intension to simulate interest in this process by applying it to products that can be socially beneficial as well as profitable. Markets in India, China and South America represent unlimited opportunities for rotational molders. Concepts such as these will be transformed into reality when visionaries within the industry expand their markets by improving technology and setting their sites on bigger horizons.

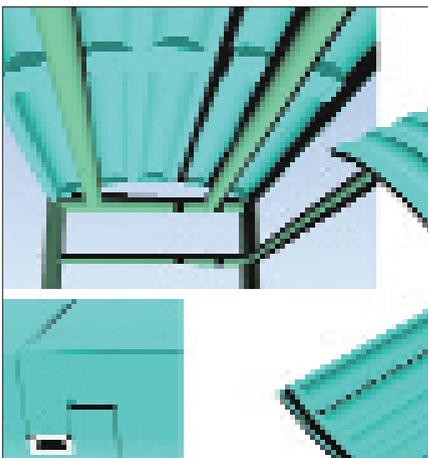


Photo 20: Stand Roof



Photo 21: Stand Benches

cultural influences.

The concept shown in Photo 19 illustrates one possible design for a rotationally molded bus stop well suited for India. This system includes only three rotationally molded modules based on 120 cm increments, which permit custom configurations for various length bus stops. Modules would be shipped to a site within compactly stacked pallets and assembled to a steel or aluminum frame

panels provide a location for extruded gaskets to be compressed. These sealed joints prevent rain water from entering the bus stand without the labor of caulking.

Molded in slots impart rigidity, design appeal and water drainage to rotationally molded benches. Simple rigid bench designs are easily molded and assembled to the steel super structure with conventional hardware. (Photo 21). Similar use of patterned circular