Feature Articles

$30 Million Facility
OHIO'S TRANSPORTATION RESEARCH CENTER OPENS

The $30 million Transportation Research Center of Ohio was officially opened July 10, 1974, as 3000 onlookers watched Ohio Governor John J. Gilligan cut the ribbon and racing champion Mark Donohue inaugurate the test track at speeds close to 200 mph.

Governor Gilligan, referring to the lease income of the facilities and the ultimate benefit to the public in safer transportation and in economic growth for Ohio, said, "The considerable investment by Ohioans in the center will be paid back many times over." Ohio voters approved funds for construction of the center in 1968.

Demonstrations of the major facilities were spearheaded by a high-speed run on the 7½-mile test track by former Indianapolis 500 winner Mark Donohue. Donohue, who is now president of Penske Racing, Inc., called the center "an engineer's dream. In my opinion it's got every type of testing mode that could possibly be dreamed up. I think it's going to be a very exciting thing and will become very successful."

Other drivers making demonstration runs on the track included Zora Arkus-Dontov, the brains behind the Chevrolet Corvette.

Located at East Liberty, Ohio, approximately 40 miles from Columbus, the TRC provides facilities for research and development of automotive vehicles and other devices related to transportation.

Although it was first conceived as a facility of Ohio State University, which conducts a substantial amount of research and development on its own initiative, the center has evolved instead as an independent agency that has as its goal the provision of extensive facilities to any persons, companies, and governmental agencies actively involved with research and development of motor vehicles. Results of the research or tests are the property of the user, whose privacy and proprietary rights are strictly protected at all times.

The 4 major facilities at the Transportation Research Center are now in use. A number of supporting facilities are complete, and additional ones are either under construction or in the planning stage.

Crash Simulator

The largest crash simulator (impact sled) currently available in the western hemisphere to researchers is housed in a 25,000-ft^2 building at the center.

The TRC crash simulator is a Bendix Hyge unit featuring a 10,000-lb payload capacity sled, which is accelerated pneumatically by a 24-in. diameter piston with a stroke as great as 6 ft.

The maximum TRC sled payload of 10,000 lb can be accelerated at 44 g, simulating an impact of 71 mph. By comparison, the maximum payload capacity of 12-in. Hyge units is 5000 lb. At this payload, 12-in. sleds can be subjected to a maximum acceleration of only 24 g or a simulated 46-mph impact.

Research experiments and tests being conducted on the crash simulator are currently pointed toward the reduction of injuries or deaths or both in the event of motor vehicle or pedestrian accidents.

The equipment used to gather data from tests on the simulator provides more than 65 channels to collect data generated during tests. A complete data reduction system is also in operation for customers wishing this service.

Motion pictures taken as fast as 11,000 frames per second may also be used to record the wide variety of testing conducted on the sled. Photographic lighting provides 12,000 ft-c of illumination in the test area. Color motion pictures of the tests, at 1000 frames per second, are available to the customer within an hour, if desired, permitting a short turnaround time and adjustment of the test conditions before subsequent tests.

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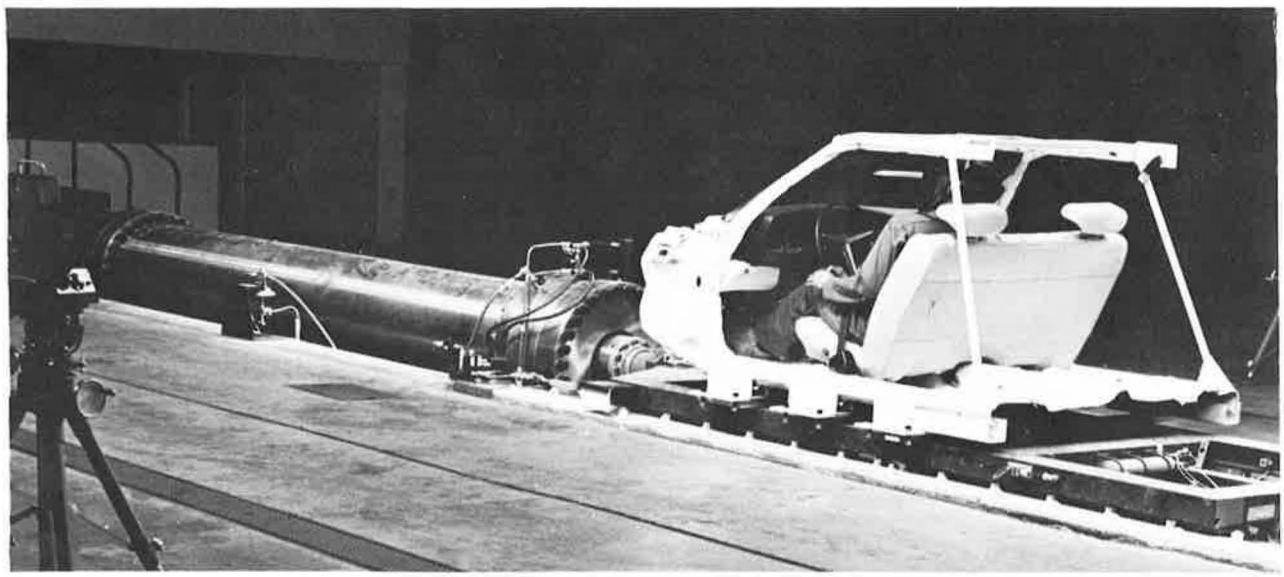
1 Television cameramen try to keep their footing on the steeply banked high-speed test track as they interview Roger Dreyer, chairman of the Transportation Research Board of Ohio, the agency that operates TRC. At the top of the curve the track is banked more than 32 deg.

2 Governor Gilligan talks to the 3000 people who attended the opening. Seated at far left is J. Phillip Richley, director of the Ohio Department of Transportation and a member of the Executive Committee of TRB.

3 Salt Walther, the racing driver who was critically burned in an Indianapolis 500 crash in 1973, was present at TRC to narrate Mark Donohue's driving activities. Walther resumed his racing career at Indianapolis this year.

4 Mark Donohue, a former Indianapolis 500 race winner, now retired from competition driving and president of Penske Racing, Inc., chats with Ohio Governor John J. Gilligan before officially opening the center's 7½-mile high-speed test track by driving a lap at nearly 190 mph.



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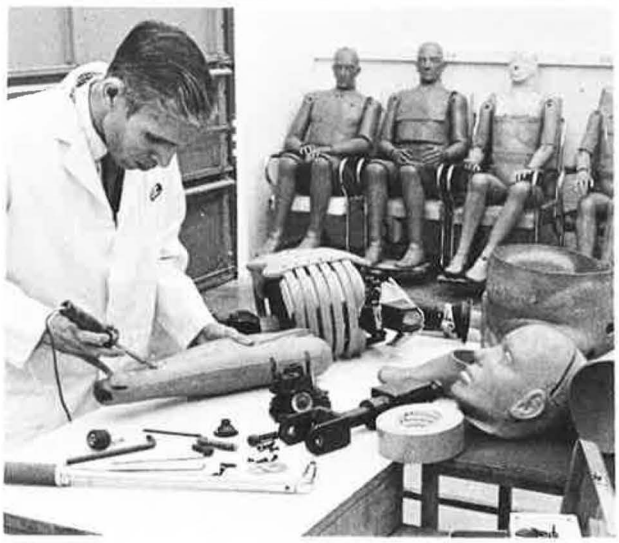

5 Simulated impacts at speeds as high as 71 mph can be achieved on the Bendix Hyge crash sled, described by TRC as the largest crash simulator currently available to researchers in the western hemisphere.

6 A technician makes adjustments to anthropomorphic dummies used in crash testing at the Transportation Research Center of Ohio, which was officially opened July 10.

Powered by high pressure air, the TRC simulator can handle complete cars, parts of cars, truck cabs, and portions of buses in simulated crashes. The facilities are also large enough to permit similar testing of components, cockpits, and portions of aircraft passenger compartments.

The impact device is not just limited to safety devices concerned with the occupant; other vehicle components may be tested for shock, vibration, stability, and soundness of design.

Typical development and test applications include (a) occupant-restraint studies of items such as seat belts, shoulder harnesses, inflatable occupant restraints, and head restraints and (b) interior impact-protection-system studies of items such as padded instrument panels, frangible controls, energy-absorbing steering columns, and safety glass.

Vehicle Dynamics Area

The vehicle dynamics area (VDA) is a 1200- by 1800-ft asphalt pad having loops with slightly different configurations at the north and south ends. The north loop is designed to allow entry and exit from the test surface at speeds of 45 to 70 mph. The south loop is designed for speeds of 60 to 90 mph. The lower speeds cited are at 0 lateral g; the higher speeds are at 0.5 lateral g.

The test surface covers 50 acres and has a 1 percent downward grade from north to south. There is no cross slope.

Composition of the pad and turnaround loops is bituminous concrete. The pad has provisions for wet and dry testing. Nominal skid numbers are 60 to 70 on dry pavement and 20 to 30 on wet pavement.

Load capacity of the pad and turnaround loops is 36,000 lb maximum single-axle weight and 48,000 lb maximum tandem-axle weight.

The north loop has a 630-ft radius and is 29 ft wide with a 5.4-deg bank. The south loop has a 764-ft radius and is 29 ft wide with an 8.1-deg bank.

Because of the large size of the VDA, many stylized maneuvers can be safely performed on it. These range from normal operating conditions to the limits of vehicle controllability. Maneuvers using combinations of speed and longitudinal and lateral acceleration, such as J-turns, serpentine or slalom courses, and circular courses, are used in studying vehicular reaction and the combination of vehicle driver reaction.

The large size of the VDA facilitates safe performance by large trucks of large path-deviation maneuvers at high speeds such as tests of the effectiveness of antijackknifing devices. It also permits tests of cars, trucks, and buses with various degrees of brake, steering, and suspension system degradation.

In addition to vehicle handling and stability, the VDA is ideally suited for controlled sound testing under many procedures of the Society of Automotive Engineers.

Skid Pad

The skid pad is basically a tire and brake test facility, but it has many other uses. The 84-ft-wide pad with test surfaces as long as 2500 ft provides four 21-ft-wide lanes with a 0.5 percent downgrade from north to south and no cross slope. There are provisions for wet and dry testing.

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1 Aerial photograph of the Transportation Research Center shows the vehicle dynamics area in the center, the skid pad, and a section of the high-speed test track in the foreground.

2 Mark Donohue runs high on the track as he propels his race car through the curve on the high-speed test track at an average speed of 190 mph.

3 Demonstrating the effectiveness of new brake systems in stopping the truck under dry and wet pavement conditions, this 72,000-lb vehicle goes through its paces on the 9000-ft-long skid pad at TRC.

4 Slalom tests through the cones on the vehicle dynamics area demonstrate the safety aspects of the asphalt pad, which measures 1200 by 1800 ft.

Test surfaces overlaid on concrete base, wet and dry skid numbers, and test length are as follows:

Concrete	Dry Skid Number	Wet Skid Number	Distance (ft)
Rough	90 to 100	75 to 85	1000
Interstate	70 to 80	55 to 65	2500
Smooth	55 to 65	25 to 35	2500

Load capacity of the skid pad is 36,000 lb maximum single-axle weight and 48,000 lb maximum tandem-axle weight. The same capacities hold true for the turnaround loops, acceleration straightaways, and transition and turnarounds at each end of the pad. All are paved with portland cement concrete.

Loop speeds are designed for 45 mph with 0 side force and 60 mph with 0.5-g lateral acceleration.

Higher test speeds may be accommodated, depending on the acceleration and maneuverability characteristics of the test vehicle and its probable stopping distance.

Both turnaround loops have a 309-ft radius and are 16 ft wide with a 0.25-ft/ft superelevation. The acceleration lanes at each end are 3280 ft in length.

Principal use of the skid pad is for the evaluation of the performance of the tires and brake system for different simulated surface conditions as characterized by skid number. The effectiveness of tires or brake system components, such as brake antilock and load proportioning devices, is generally measured in terms of straight-line stopping distance. Typical of the procedures that may be used are those of SAE J345a. The skid pad can also be used to measure stopping distance in compliance with federal motor vehicle safety standards.

High-Speed Test Track

The 7½-mile oval test track encloses a 1600-acre area, 1 mile wide and 3½ miles long.

The track has a downward grade, from north to south, of 0.228 percent and a cross slope on the straightaways of 3/16 in./ft. The 1.88-mile long straightaways flow into transition areas 2300 ft long and then into 5275-ft-long curves that have a constant radius of 2400 ft. The pavement, designed to provide 3 lanes, is 36 ft wide in the straightaways and 42 ft wide in the curves. In addition, there are paved berms 12 ft wide on each side of the straightaways and inside the turns.

In the curves, as a vehicle moves toward the outside of the track, it encounters a progressively steeper bank. At the far outside of the track, the surface is banked at more than 32 deg. The inside or slow lane has an average 8.5-deg bank, which allows speeds of 80 mph through the turn with no side force. The middle or intermediate lane has an average bank of 15.3 deg, allowing speeds of 110 mph with no side force. The outside or high-speed lane has an average bank of 24.3 deg, permitting speeds of 140 mph with no side force.

The track is paved with portland cement concrete and has a maximum single-axle load of 36,000 lb and a maximum tandem-axle load of 48,000 lb. Special arrangements may be made for testing heavier vehicles.

The combination of long straightaways, concrete surfaces, and insignificant grade make the test track ideally suited for vehicle and tire performance testing, both for regulatory purposes and for product development.

Weigh Scale

The weigh scale has a special split platform feature to allow the measurement of single-wheel weights. The totalizer provides total vehicle weight as well as individual axle weight. The capacity is 30 tons.

Brake Slope

The brake slope features 2 steep slopes that allow testing of the holding power of truck and automobile braking systems. One side of the brake slope has a 20 percent grade, and the other side has a 30 percent grade in compliance with requirements of FMVSS 121 and 105 respectively.

Brake Soak Tank

The brake soak tank, under construction, will contain water so that automobiles or trucks may be driven in the water to soak the brake systems preparatory to testing with wet brakes. Water depth is adjustable to 2 ft.