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SAFER ROADS AND HIGHWAYS THROUGH HIGH PERFORMANCE COMPUTING

High performance computing is providing engineers and planners with the best information ever available for designing safer roads and highways. A futuristic "smart" highway system, using powerful parallel processors to create traffic safety, is also under study.

The California State Department of Transportation (CalTrans), working with the San Diego Supercomputer Center (SDSC), is a leader in using high performance computer technology to improve its vast road and highway system. Their work also fosters informed decision-making in other states and provides information to the Federal government for shaping national highway policy.

The following are two examples:

CRASH-TEST VEHICLE -- Decisions regarding the design and placement of signs and light posts along California's highways result from complex engineering analysis. One consideration is the amount of damage a vehicle will sustain in collision with such fixtures. Engineers from CalTrans and SDSC have created a new computational crash-test vehicle that emulates the front-end impact of a compact car in various collision situations. Thus, high performance computing substitutes for expensive, time consuming real vehicle testing.

Fine-tuning the design and placement of narrow poles that support signs and lighting, as well as wide fixed objects like bridge abutments, and longitudinal barriers such as guard rails, through such testing, enhances road safety.

Soon this new crash-test model will undergo validation tests conducted jointly by CalTrans and the Federal Highway Administration's Federal Outdoor Impact Laboratory (FOIL). The results should also expand FOIL's crash-test capabilities and be used to further refine the CalTrans/SDSC model.

The data derived from such crash-testing improves engineering and planning of roadside structures and yields information helpful to the auto industry in designing safer cars.

IMPROVING PAVEMENT -- CalTrans is using the advanced analytical and visualization resources of SDSC to test innovative road paving materials for durability and safety. High performance computing is much faster than conventional field testing and yields more accurate insights.

Of particular interest is the impact of recycled materials and polymer modified binders on the durability of paving systems, as compared with conventional asphalt-surfaced roadbeds. Concerns include the response to new truck suspension systems and different axle and tire configurations, including varying tire sizes and heavier tire loadings.

The results are expected to lead to major cost savings in the design, construction, maintenance and rehabilitation of pavement structures. Since California incorporates a wide range of climates, the paving it uses must tolerate differing weather conditions and dramatic fluctuations from hot to cold. What works well in California will find significant applications in other geographic areas.

INTELLIGENT VEHICLE HIGHWAY SYSTEMS (IVHS) --

The most advanced parallel processor of the Ohio Supercomputing Center (OSC), tying together 32 machines and capable of 6.3 billion calculations per second, is being used by a civil engineer at Ohio State University in research to create computer-monitored streets and highways of the future.

These "smart highways" will rely on in-car computers that receive commands from a central traffic computer, including updates on road conditions such as traffic jams, construction delays and accidents, and recommendations for alternate routing. Monitoring and controlling traffic patterns is aimed at creating safer roadways.

Some cities already have the rudiments of smart highway systems--large computer controlled signs that describe road conditions, accidents, weather and alternative routing. But the more advanced system relies on communications between a "smart car" and centralized computers.

The amount of detail and number of variables needed to make such a system viable would overwhelm anything but the most advanced massively parallel processor.