

Load Rating and Permit Vehicle Routing

MARK NORD

Colorado Department of Transportation

GEORGE HOVEY

InMotion, Inc.

ABSTRACT

The Colorado Department of Transportation (CDOT), through an agreement with In Motion, Inc of Denver, Colorado, has developed an automated Windows-based PC system for issuing permits for most of the 100,000+ extra-legal load requests Colorado receives each year. The automated system relies on GIS information to track the current status of the State's highway network.

The system documents pertinent ownership and load information about a truck, checks height, length, and weight restrictions (up to 200,000 lbs), determines an appropriate route, identifies special needs such as pilot cars when necessary, and issues a permit to the trucking firm electronically. The system can select a route for the trucker automatically, check a route requested by the trucker, select a "common route" or, a route can be selected by "point-and-click" on a map.

The system is flexible and is used to issue single trip and annual permits. The system logs all requests and creates an electronic "rolodex" database of requestors, which saves time and eliminates errors for future requests from the same company. Based on predefined axle and axle group criteria, the system is used to permit loads up to 200,000 lbs.

Permit requests for loads over 200,000 lbs are sent to, and reviewed by, engineers in CDOT's Staff Bridge Branch Rating Unit. Over the years, we have developed tools to help expedite our analyses and provide faster turn-around to the trucking industry. Some of these tools have been incorporated into the automated system and future enhancements will include more of these tools to aid in evaluation of loads greater than 200,000 lbs.

This paper will describe the automated system, the enhancements to the system currently being worked on, the current method of reviewing overload requests (less than as well as greater than 200,000 lbs), and the future automation for loads over 200,000 lbs.

INTRODUCTION

Improved safety and protection of the public's infrastructure investment are the purposes of States' permitting and routing of overdimensional truckloads. The Colorado Department of Transportation (CDOT) has been aggressively advancing new methods of meeting these objectives through issuing trip and other Oversize/Overweight (OS/OW) permits. In addition, there are institutional pressures to meet the increasing volume of permitting with fixed or even reduced resources. There are four focus elements to address these issues:

- Internal automation of issuing permits and associated accounting/reporting to move towards a paperless environment,

- Automated analysis and route selection,
- Improved analysis of superloads (200,000 lbs and over), and
- Improved service to customers.

Internal Automation

The Department issues a variety of Oversize/Overweight permits to industry:

Permit	Function	Issued/yr.
<i>Trip Permits</i>	Allows individual permitted load on a specially designated route with certain restrictions. (VIN specific permit)	100,000
<i>Annual Permits</i>	Allows industry within an envelope to travel within published route constraints. (VIN specific permit)	3,000
<i>Fleet Permits</i>	Provides utilities an annual permit for the transport of equipment and supplies. (Fleet permit)	300
<i>Longer Combination Vehicles</i>	Combination of permits allowing for LCV usage on a restricted number of designated routes. (Fleet and VIN specific permits)	1,800
<i>Special Permits</i>	Detailed load and route analysis. Items include large vessels, houses, etc. (VIN specific permit)	150

Exhibit 1: Colorado OS/OW permits.

CDOT, in association with In Motion, Inc. (IMi) developed a commercial vehicle electronic credentialling system as one of three national Federal Highway Administration (FHWA) funded Intelligent Transportation System (ITS) Commercial Vehicle Operations (CVO) operational tests. While that effort focused on registration and tax credentials, it also led the team to pursue the use of similar technology and systems to improve the issuance of OS/OW permits.

The system, named FASTRACS for Fast Truck Routing and Credentialling System, has evolved into a network-based multiple-user environment. FASTRACS is now the intellectual property of Lockheed-Martin IMS and has been bundled within their package of state permitting tools, ExpressConnect.

The FASTRAC system provides a series of user-friendly screens to address a wide range of permit-related issues, including basic company administrative records, payment methods, agent data, and load and vehicle configurations. The user signs onto the system and views a toolbar of modules:

- Point and click on **Trip Permit** and the operator is directed through the steps necessary to issue a trip permit. The **Annual Permit** module functions in a similar manner.
 - **Reports** provides a variety of pre-formatted reports and ad hoc reporting capabilities, seen below.
 - **Query** allows the operator to drill down into the database to whatever amount or level of data is required.
 - **Company** is a populated database of all company and associated data necessary to issue a permit.

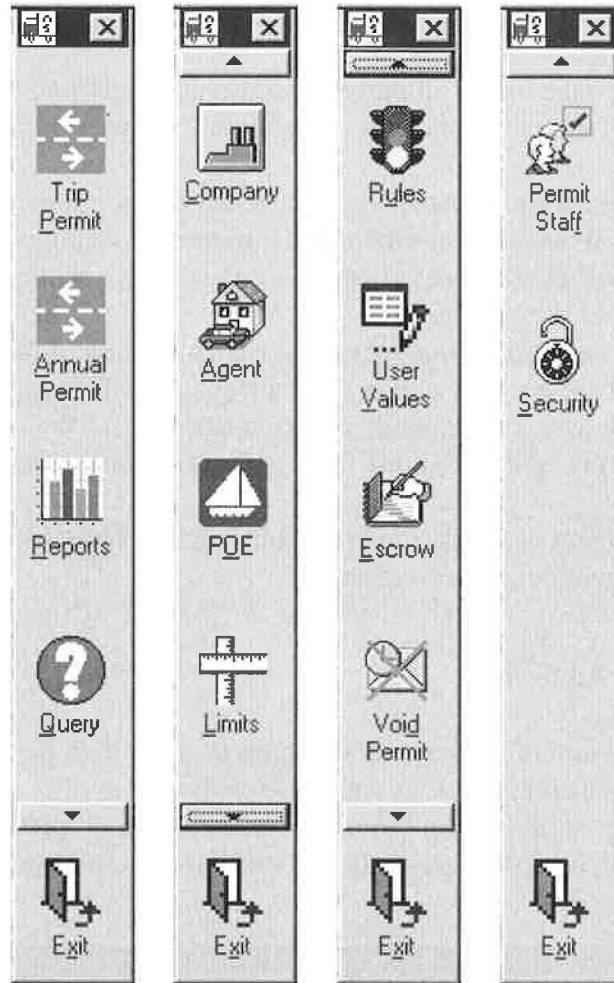


Exhibit 2: FASTRAC toolbar.

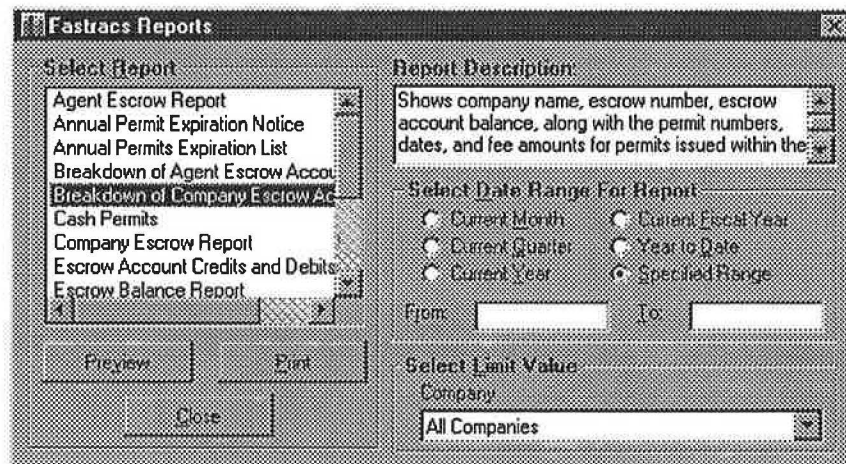


Exhibit 3: Report selection screen.

- **Agent** provides the information for service bureaus that represent the trucking firms.
- **POE** also provides access to contact and information related to each state Port of Entry.
- **Limits** provides the universal numeric values of weight and height restrictions. These are structured to allow the office to make modifications as rules and limitations evolve over time.
- **Rules** addresses agency business practices and can be set by the user including fees for utilizing escrow accounts or credit cards; minimum and maximum limits for accounts; etc. **User Values** addresses selectable data such as updates to cargo types, unique restrictions, void reasons, etc.
- In some instances, CDOT may never have a paper copy of the permit. To maintain careful audit control only authorized staff may **Void** credentials, at which time all associated accounting is automatically reversed out.
- **Permit Staff** sets up the administrative and operational structure for use of the system.
- **Security** addresses access to modules, limiting the ability to manipulate information and data without authorization.

Route Selection and Analysis

The following progression of screens demonstrates how the Trip Permit Module assists staff in business rules, load restrictions and route analyses.

This initial screen in the Trip Permit Module (Exhibit 4) provides and assists in the accumulation of all company, payment, fee and destination information. Data from

A. M. Welles Inc.

55 Mobile Command & Control
7 Star Trucking
9061-2110 Quebec Inc. Unlin
A & B Maine Trucking
A & R Transport
A G K Corporation
A New Company
A Really Big Company
A to Zipoly Transport
A. M. Welles Inc.
A-1 Organics
Access Transportation System
Ace Construction Corporation
ACE Transportation
ACE Transportation (TX)
Acme Explosives
Acme Products Company
Acme Transportation
Acme Truck Line
Adaboy Trucking
Adams & Son Company
Adams & Son Trucking Inc.
Adams Construction
Adams Construction Compan
Adams Culvert
Adams Culvert Company
Adams Family
ADK Midcal
Animal Merchants Motor Firm

Permit for Company

Company Name: A. M. Welles Inc. FEIN:
Company Office: Main USDOT:
Driver Name: Escrow Balance: \$1,020.00

Select Payment Method

Cash Escrow Account Credit Card POE Collects Fee
 Agent Escrow Account: Brians Permit Service Walk-In

Days for Permit

Same Day 2 3 4 5 6 From: 03/01/1999 To: 03/04/1999

Permit Faced To

Agent Company Office POE
 Other Fee Number: (310) 26-0944

Fee Calculation

CW OS OS/TPW No. of Axles: 5
 Charge No Charge (Govt.)
 \$2 Fee Retiree
\$17.00

Close Back Next

Exhibit 4: Company information screen from trip permit.

previous permits are retained and automatically populate the appropriate fields of the screen, eliminating the need for unnecessary data entry.

The second screen (Exhibit 5) addresses cargo provisions, unique construction equipment and mobile home issues, vehicle data and dimensional variances.

The third sequential screen (Exhibit 6) accumulates data related to the vehicle/axle configurations. As data is being entered, the system is verifying that the primary dimensions are within acceptable limits.

The fourth in the series of Trip Permit screens (Exhibit 7) provides the mechanism to input the origin and destination of the specific trip.

This can be done by highlighting the location on the list under Cities, Ports of Entry or Border Crossings, or unique identifiers may be entered manually. The staff member has the opportunity to enter the route segments manually if there is not a question related to the acceptability of the requested route.

The ArcView GIS can be used to route load from the designated termini.

GIS provides fingertip access to a considerable amount of data allowing the agent to drill down to as great detail as desired. This includes information on structures, tunnels, vertical and horizontal clearances, pilot car requirements, local municipal regulations, etc. (Exhibit 8)

Automated routing will analyze requested routes and identify locations with height and weight violations or segments with unique length or width restrictions (Exhibit 9). While it is technically possible to route a load without conflicts, there remain a number of issues that require human judgement. For example, in a diamond interchange configuration if a load were too high to pass under a structure, the staff member would generally divert the load onto and back down the access ramps, avoiding the conflict. The

Exhibit 5: Cargo and general dimension data collection.

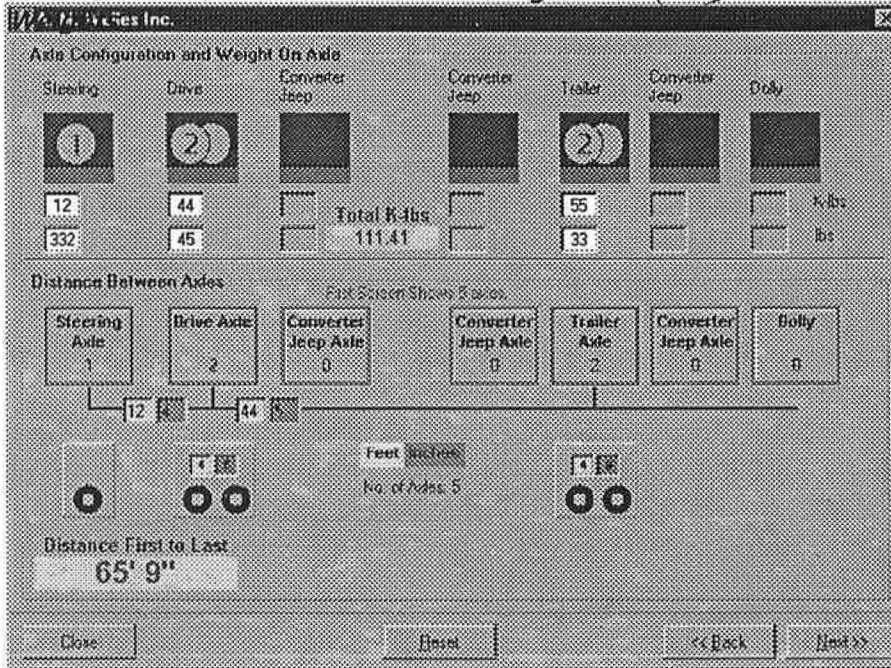


Exhibit 6: Vehicle and axle configuration and weights.

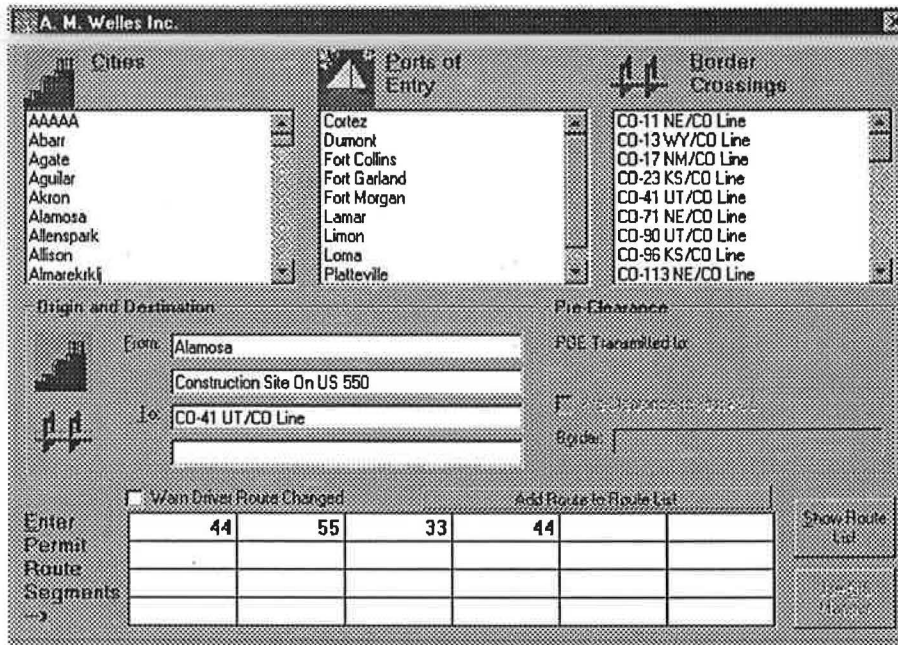


Exhibit 7: Origin and destination and route screen.

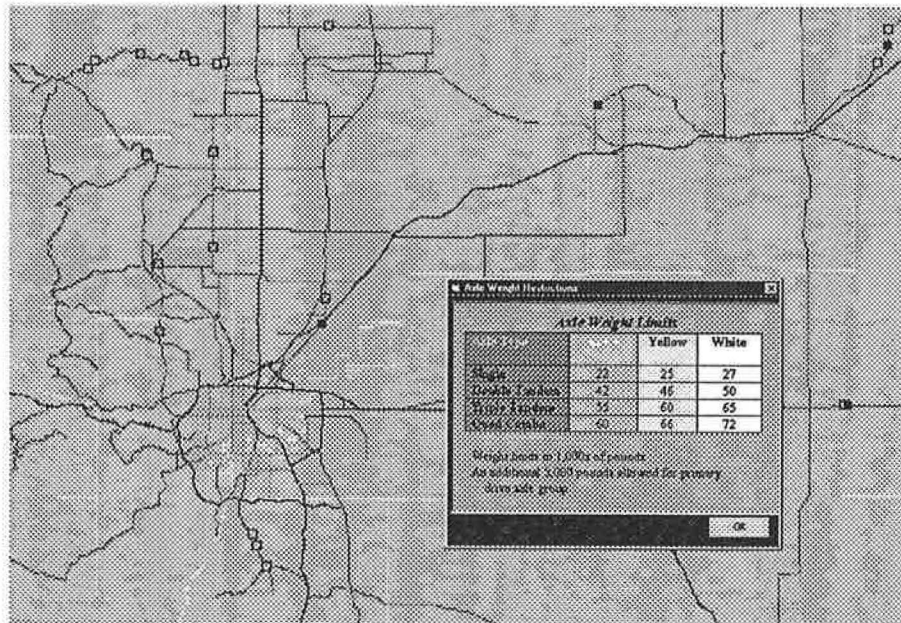


Exhibit 8: Fingertip access to data.

current database is not sufficiently robust to automatically accomplish this decision without intervention.

Upon accepting the proposed route, the system populates the route designations and provides any additional unique restrictions. The permit is then sent directly via an internal fax system to carrier, agent or even a truck stop. The permit also can be printed for delivery (Exhibit 10). All accounting and permit records are updated automatically. In Motion, Inc. is currently working with CDOT in expanding the system to address Annual, Fleet, LCV and Special Permits (load over 200,000 lbs).

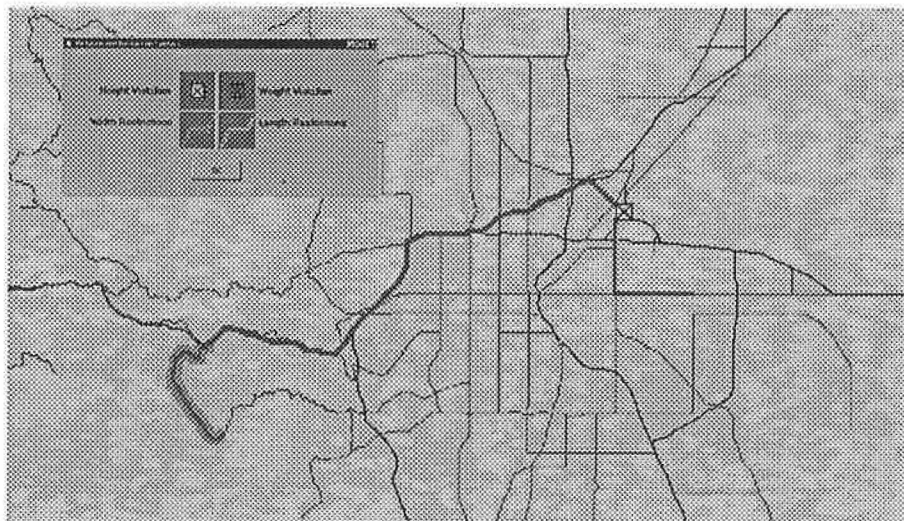


Exhibit 9: Automated routing and conflict identification.

Exhibit 10: Route restriction and issuance screen.

Permit Requests for Loads Over 200,000 lbs

Permit requests for loads over 200,000 lbs are sent to and reviewed by CDOT Staff Bridge Branch Rating Unit engineers. Over the years, the Department has developed tools to help expedite our analysis and provide faster turn-around to the trucking industry. Some of these tools have been incorporated into the automated system. Future enhancements will include more of these tools to aid in evaluation of loads greater than 200,000 lbs.

Turn-around time is a major consideration when processing extra legal permit requests. The demand for quick response is expressed by the time available between application and the requested move date. As a result, the trucking industry has motivated Colorado to continually try to find faster ways to process the requests without compromising safety or the structures.

Structure Selection

Checking all structures on a requested route is not practical or even necessary. This is especially obvious on long routes with large groups of similar structures. Deciding which are the controlling structures has been the primary motivation behind our decision support tools.

In the past, controlling structures were selected based on a combination of the operating rating; structure types, span length; and historical data that showed a particular structure would control. Today controlling structures are selected based on a combination of special truck ratings and historical data.

Historically, creating a written tabulation of the selected structures from a printed log of structures was the method used. Now the selection process is done using a PC based relational database. The selection process is now much faster and more complete. The ability to select structures faster has allowed more time for analyses without compromising turn-around time.

Method of Analysis

Historically, analysis of structures for an extralegal permit request was primarily based on an allowable stress moment check. Now that the Load Factor re-rating process is nearing completion, most extralegal permit requests are analyzed using Load Factor. This change in analysis method was motivated by the FHWA requirement that all structures be rated in accordance with the AASHTO Load Factor provisions.

Analysis

Historically, the structural analysis was done using a combination of mainframe programs (i.e., AASHTO BARS and in-house programs) and hand analysis. Now the analyses are done using a combination of personal computer based programs (i.e., AASHTO BARS-PC, Wyoming BRASS Girder and in-house programs) and some mainframe programs (i.e., in-house programs). Steadily increasing personal computer processing speeds have allowed the analysis of more structures without compromising turn-around time.

Analyzing more structures beyond the limits of previously defined structure selection criteria was initially done because we could. It soon became obvious that some structures were routinely acceptable for most of the extralegal permit requests and some structures were not, despite the relatively high operating ratings.

Tools

The tools developed to simplify processing of extralegal permit requests for loads less than 200,000 lbs. are based on allowable axle group combinations (Exhibit 11) and a standardized truck which we call the "Permit Truck" (Exhibit 12). An operating level rating based on the Permit Truck as the liveload is used to determine the relative live load capacity of the structure for extralegal loads less than 200,000 lbs. The relative capacities are broken into four different color coded groups. Black represents no extra legal loads; orange, yellow and white represent increasing loads on various axle configurations.

Based on approved extralegal loads greater than 200,000 lbs., most extralegal permit requests were discovered to be 13 or fewer axles. Extending the Colorado allowable axle group configurations to 13 axles led to the definition of the Super Load Truck (Exhibit 13). Using operating level ratings based on the Super Load truck as a measure of relative liveload capacity, the number of structures analyzed during a typical extralegal permit request has dropped and better control and repeatability of the extralegal permit process has been achieved.

Future Directions

FASTRACS allowed the partial automation of the permit process for loads less than 200,000 lbs. Extending automation to the loads greater than 200,000 lbs is our future direction. The motivation for automating the processing of extralegal permit requests






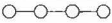
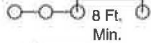

Permit Weight (x 1,000 Pounds)			Truck Axles
Orange	Yellow	White	
22	25	27	Single Axle 
42	46	50	Tandem Axle  As Pictured
44	50	54	 Treat as Single Axles
56	60	65	Three Axle Combination  As Pictured
64	71	77	 Treat as Tandem Plus Single Axle
60	66	72	Four Axle Combination  As Pictured
77	85	92	 Treat as Three Axle Combination Plus Single Axle
84	92	100	 Treat as Two Tandems

Exhibit 11: Allowable axle group configurations.

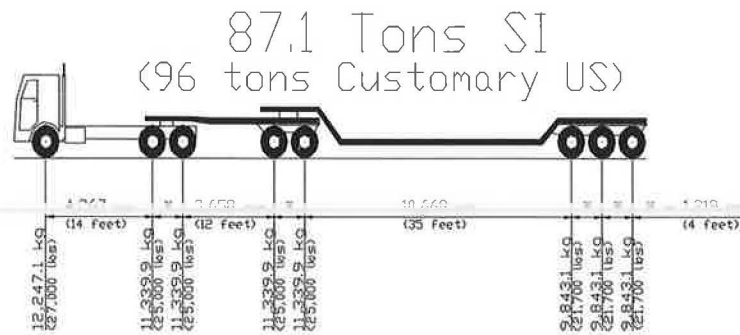


Exhibit 12: Permit truck.

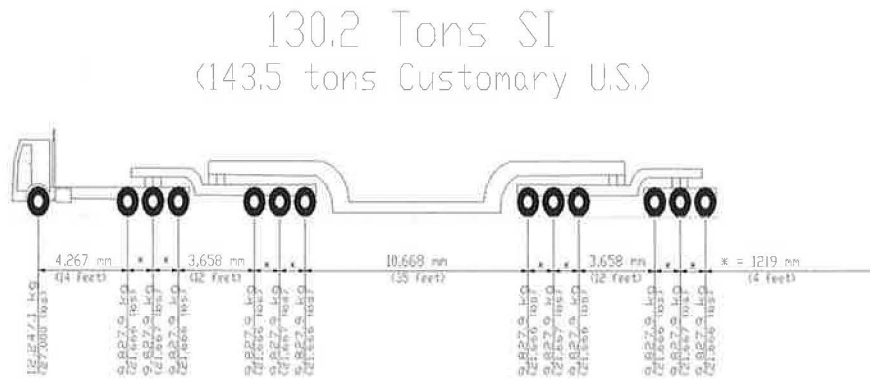


Exhibit 13: Super load truck.

greater than 200,000 lbs is the roughly three-fold increase in approved loads within Colorado over the past ten years (Exhibit 14). The intended elements of the automation are an electronic tie between our work process and the permit office; an automated structure selection process; a partially automated approval process for typical extralegal permit requests (13 or fewer axles); and an automated system for tracking extralegal permit requests.

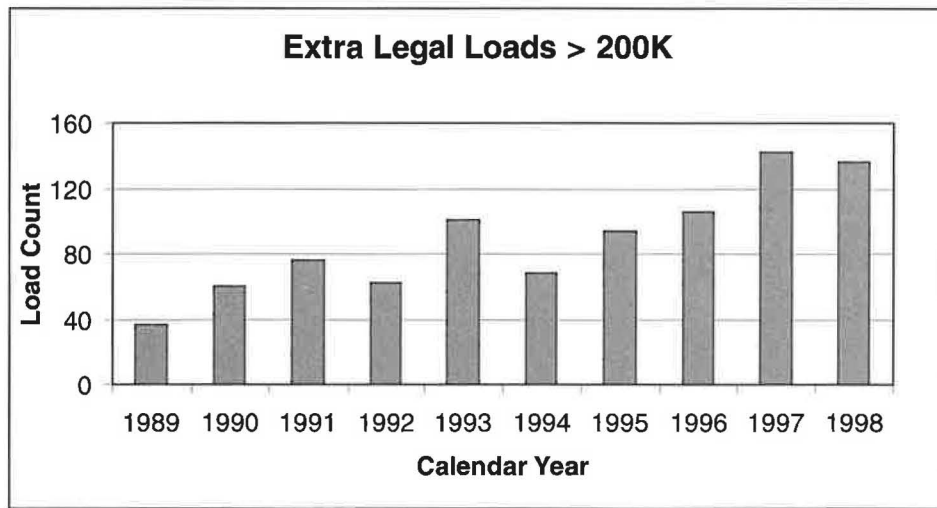


Exhibit 14: Number of annual special permits.

CONCLUSIONS

There have always been tools used to speed the processing of extralegal permit requests. As with most other areas of our society, the largest single impact has been in the adoption and implementation of computer-based systems. Changes in extralegal permit processing would not have happened as quickly without the computer. Future tools for extralegal permit request processing may become more dependent on the computer. However, it could be easy to perceive the computer as an end in itself and not a tool that should be used within the limits of its capabilities. We strive to recognize that the value is in the work not the tool. Therefore, the computer should be used to improve our understanding of the structural response to very large loads. The Department is advancing a number of efforts to improve. Additionally, to improve customer service the Department has expanded hours of operation for industry.