

APPROPRIATE TOLL ROAD TECHNOLOGIES

FOR COUNTRIES IN TRANSITION

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In recent years, many Asian and Latin American countries and other countries in transition have encouraged dramatic road infrastructure development in order to promote and sustain continued economic growth. India, for example, has seen demand for new highways achieve a level not previously experienced anywhere throughout the world. Throughout this paper, we use India as an example. However, the concepts apply equally well to many other countries in transition or in the developing phase.

One of the main features of India's current fast-track economic development has been the equally rapid development of the inter-city and national highways. The nation's current stage of development has dictated that flexible methods of financing these projects be utilized, be they through construction on a direct investment or joint-venture basis, or by floatation on international stock exchanges. Whatever method is used, **the toll** is the payback, since local administration may be unable to bear the financial burden. Most observers agree, therefore, that toll roads are the answer to India's and other developing countries' highway finance requirements.

It is critical for a toll road operator, whether a public entity or private concession operator, to ensure that toll fare collection is optimized and effective. To avoid pilferage of generated revenues, it is necessary to have an effective audit system. Any toll system should focus on anti-fraud and data security measures. For example, if a current cash-based toll road in India is collecting 20 million rupees per year, then after the installation of an 'effective' computerized toll collection system, the operators can reasonably expect to collect at least 20 percent more. Over a 10-year period, that is extra revenue of 40 million rupees.

Toll road operators and owners also need to protect their roads from unnecessary damage and premature wear. By regulating vehicle weights, a toll operator can protect the investment in infrastructure. The toll operators can target heavier vehicles for higher tolls and collect the weight information for planning of future infrastructure and for maintenance activities. Operators may also target over-loaded trucks and place restrictions upon their entry. The damage by over-loaded trucks to pavements is exponential. A 10% increase in weight results in a 45% increase in pavement damage.

This paper describes appropriate toll audit technologies, which can provide cost-effective solutions for countries in transition through revenue optimization and effective fraud control. These technologies vary from simple toll audit systems to more integrated systems.

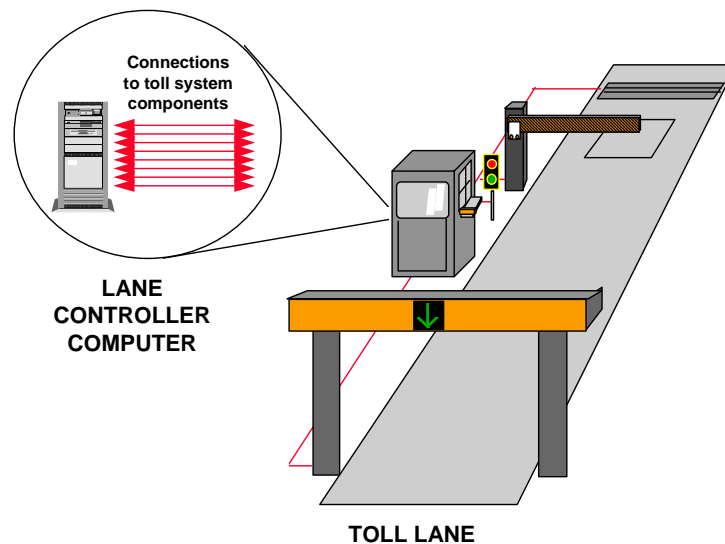
1. TCC Toll Audit System

The TCC Toll Audit System is the most basic technology for toll audit and is ideal for toll road operators who have limited budgets and/or are uncertain of their toll audit requirements. The TCC Toll Audit System uses a Traffic Counter/Classifier, which collects traffic classification data in each of the toll lanes. The TCC System allows the toll road operator to monitor the traffic count and classification information for each lane in a plaza, and to match this information to a set time period, such as the duration of an operator's shift. The information is then used by the operator to cross-check the actual collected revenue, as compared to the traffic data.

2. Lane Controller Computer, Plaza Computer, and Central Administration Computer

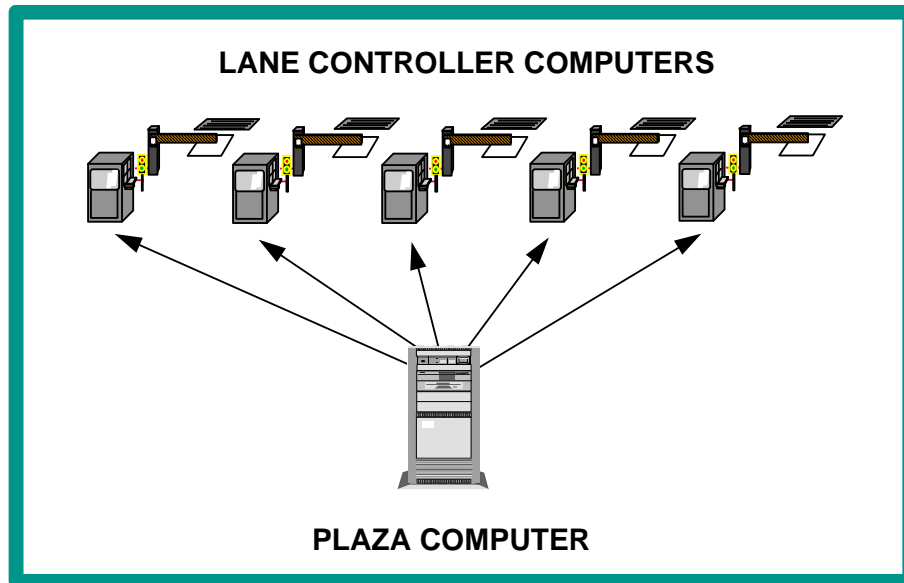
2.1 Lane Controller Computer

A more advanced system employs a Lane Controller Computer for each toll lane. The advantage of a Lane Controller Computer in each lane is that even if the Plaza Computer's operation is disrupted, the Lane Controller Computer continues to operate and data collection continues uninterrupted. The Lane Controller Computer accepts inputs from the operator console, performs calculations, records data, controls the operator display, accepts inputs from vehicle classification sensors, and communicates with the Plaza Computer.



2.2 Plaza Computer

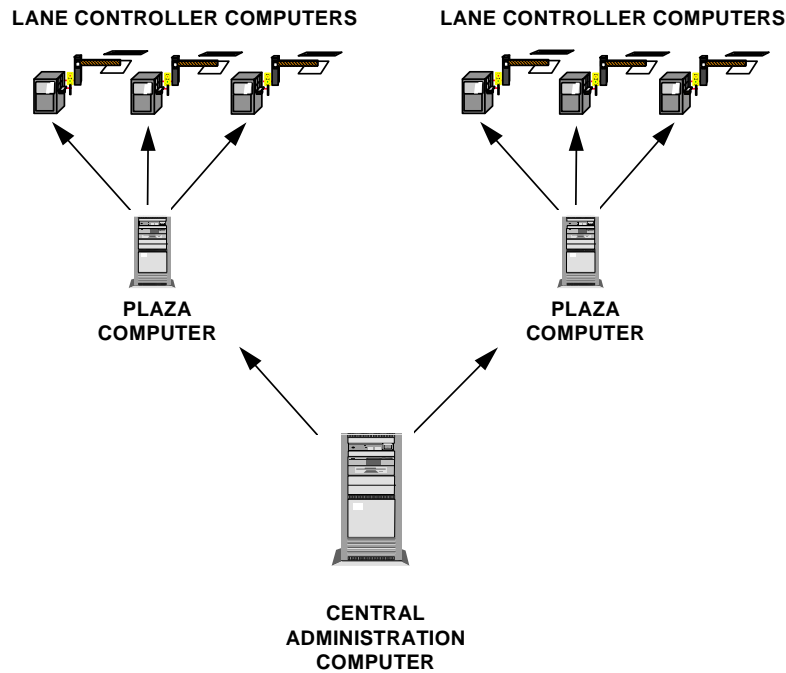
The Plaza Computer provides information to the plaza supervisor and allows the supervisor to monitor the activity of the toll plaza. The Plaza Computer is linked to each Lane Controller Computer at the toll plaza. The Plaza Computer may also be linked to a Central Administration Computer.



2.3 Central Administration Computer

The Central Administration Computer (CAC) receives information from the Plaza Computers. The Plaza Computers will normally be connected to the Central Administration Computer at all times, in order to maintain current information from the plazas and to enable continuous monitoring of the plazas. While the Administration Computer is disconnected from the Plaza Computer, the Plaza Computer stores the information until the connection is re-established.

The central computer can be located in the investor's or toll road operator's head-office, for access to data on both a real-time and record-and-review basis. This allows investors to cross-reference traffic volumes and classification data against collected toll revenue. These measures proactively discourage any conspiracy to defraud by means of data manipulation before reporting the results through conventional channels, thereby maximizing revenue and tracking return on investment.



3. Weigh-In-Motion (WIM)

A Weigh-In-Motion (WIM) System may be integrated with the toll system for more effective operation. Weigh-In-Motion allows for a higher throughput and efficiency at toll operations. With static scales, long truck queues and lengthy delays may result. The addition of WIM to the toll system makes it possible to collect fares based on vehicle weight, as well as vehicle classification. Since heavier vehicles tend to cause greater wear and tear on roads, collecting fares based on weights ensures that the vehicles causing the most damage pay the higher fares.

Conclusion

Countries in transition require significant road infrastructure to grow economically and to increase productivity. Many countries cannot afford to undertake the required infrastructure development. Therefore, countries in transition turn to toll roads and private investment to meet their requirements.

It is important for toll and concession operators to audit the actual traffic against revenue receipts. Several systems are available to assist operators in this respect, including TCC Toll Audit, Lane Controller Computer, and Weigh-In-Motion Systems. The appropriate system is based on specific site requirements and budgetary resources.