Highlights

This edition of the C&P report is based primarily on data through the year 2002, covering the first 5 years of the 6 years for which Federal highway and transit funding was authorized by the Transportation Equity Act for the 21st Century (TEA-21). The trends identified in this report reflect not only more recent data than the last edition, but also enhancements to the analyses based on ongoing work by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) to improve the estimation of the conditions and performance of highways, bridges, and transit and to forecast the future investment that will be required to maintain and improve this transportation infrastructure.

While this Highlights section focuses on the TEA-21 period, the report also includes data from other years and comparisons to other periods (such as the two years since the last edition of the C&P report).

Highlights: Highways and Bridges

Since TEA-21 was enacted, combined investment by all levels of government in highway infrastructure has increased sharply. Total highway expenditures by Federal, State, and local governments increased by 33.3 percent between 1997 and 2002, to $135.9 billion. This equates to an 18.4 percent increase in constant dollar terms. Highway capital spending alone rose from $48.4 billion in 1997 to $68.2 billion in 2002, a 41.0 percent increase. Federal cash expenditures for highway capital purposes increased 56.7 percent from 1997 to 2002, while State and local capital investment increased by a smaller (though still robust) rate of 29.7 percent. It is important to note that, owing to the nature of the Federal-aid highway program as a multiple-year reimbursable program, the impact of increases in obligation levels phases in gradually over a number of years. The Federally-funded portion of total highway capital investment for all levels of government had dipped below 40 percent in 1998 for the first time since 1959, as TEA-21's passage relatively late in fiscal year 1998 reduced its impact on cash expenditures during that initial year. However, this share has subsequently rebounded sharply, reaching 46 percent in 2002, consistent with the high end of the range of 41 to 46 percent that was observed for each year between 1987 and 1997.

The TEA-21 era has also coincided with a shift in the types of capital improvements being made by State and local governments. The percentage of capital investment going for "system preservation" (the resurfacing, rehabilitation, or reconstruction of existing highway lanes and bridges) increased from 47.6 percent in 1997 to 52.6 percent in 2002. The combined result of the increase in total capital investment and the shift in the types of improvements being made was a 55.6 percent increase in spending on system preservation, from $23.0 billion in 1997 to $35.8 billion in 2002. Compared with system expansion projects, system preservation projects tend to have shorter lead times and are often less controversial, which made many of them attractive candidates as Federal funding increased over this period. Investment in system expansion (the construction of new roads and bridges and the widening of existing roads) grew more slowly during this period, rising 23.2 percent from $21.5 billion in 1997 to $26.5 billion in 2002.

Physical Conditions Have Improved

The large increase in system preservation investment since 1997 has had a positive effect on the overall physical condition of the Nation's highway and bridge infrastructure. The percentage of highway mileage with "acceptable" ride quality rose from 86.6 percent in 1997 to 87.4 percent in 2002, while the percentage

of highway mileage with "good" ride quality improved from 42.8 percent to 46.6 percent over the same period. The improvement has been concentrated on rural roads and higher-order roads in urban areas; conditions on lower-order urban roads have worsened in some cases.

The percentage of bridges considered deficient dropped from 31.4 percent in 1996 to 27.5 percent in 2002, with most of the progress made on bridges with structural deficiencies, rather than on bridges considered to be functionally obsolete. Bridge condition also differs by functional system. For example, the percentage of Interstate bridges classified as structurally deficient or functionally obsolete is lower than the comparable percentages for bridges on collectors or local roads.

Operational Performance Has Declined

Despite the historic investment in highway infrastructure and improving conditions on many roads and bridges, operational performance—the quality of use of that infrastructure—has steadily deteriorated over the past decade. This is reflected in measures of congestion in all urbanized areas developed for FHWA by the Texas Transportation Institute (TTI). From 1997 to 2002, the estimated percent of travel occurring under congested conditions has risen from 27.4 percent to 30.4 percent. Annual hours of traveler delay has risen from an average of 19.4 hours in 1997 to 23.8 hours in 2002. [Note that these statistics are different than those found in TTI's annual *Urban Mobility Study*, which is based on a subset of urbanized areas weighted towards the most heavily populated areas.]

Future Investment Scenarios

Maintaining the overall conditions and performance of highways and bridges at current levels would require an increase in the combined amount of investment from all levels of government, relative to current expenditures. The "Cost to Maintain Highways and Bridges" scenario describes a level of investment at which future conditions and performance would be maintained at a level sufficient to keep average highway user costs from rising above their 2002 levels, based on projections of future highway use. The average annual investment level for this scenario is projected to be $73.8 billion (in constant 2002 dollars) for 2003 to 2022, which is 8.3 percent more than the $68.2 billion of capital spending in 2002. Note that, if capital spending were to rise to the Cost to Maintain level, the vast majority of this increase, given current sources of highway funding, would likely be borne by highway users. Note that this "gap" reflects future investment requirements stated in constant dollars; additional annual increases in investment would be required to offset the effects of inflation. Note also that capital expenditures for bridge preservation in recent years have exceeded the bridge preservation component of the "Cost to Maintain Highways and Bridges" scenario, a trend that has led to reductions in the percentage of bridges classified as deficient.

Additional increases in highway capital investment would also result in positive net benefits to the American public through further reductions in travel time, vehicle operating costs, crashes, emissions, and highway agency costs. The "Maximum Economic Investment (Cost to Improve Highways and Bridges)" scenario presented in this report describes an "investment ceiling" above which it would not be cost beneficial to invest. The average annual "Maximum Economic Investment" level is projected to be $118.9 billion for 2003 to 2022 (stated in constant 2002 dollars). This is 74.3 percent higher than the $68.2 billion of total capital investment by all levels of government in 2002. Note that this scenario is largely theoretical in nature, and does not reflect practical considerations such as whether the highway construction industry or the highway planning process would be capable of absorbing such a large increase in funding within the 20-year analysis period. In particular, the legal and political complexities frequently associated with major highway capacity projects can significantly extend the time required for their implementation.

The highway investment analysis procedures used to develop the investment requirements scenarios have been modified for this edition of the report to reflect the impact that certain types of operational strategies and Intelligent Transportation Systems (ITS) deployments may have on system performance. Considering operations strategies and investments, which are considerably less costly in terms of initial outlays than conventional capacity investments, results in a lower estimate of the amount of investment necessary to achieve a given level of performance. Any more aggressive and effective deployment of ITS and other technologies beyond that which has been modeled in this analysis would be expected to further reduce the level of future capacity investment required to achieve any specific level of performance.

It is important to recognize that, in reality, highway, bridge, and transit investments are not made optimally to achieve maximum benefit-cost results. Consequently, the models used for the investment analyses in this report may understate the actual level of investment that would be needed to achieve a particular level of performance. Note, however, that other factors may cause the models to overestimate investment requirements. For example, the highway investment requirements analysis does not account for demand management options, such as congestion pricing. If widely adopted, such strategies would improve the operating efficiency of the highway system, reducing the level of investment required to achieve a particular level of performance below the level that would be estimated by the models.

Impacts of Future Investments

In addition to the two main investment scenarios outlined above, this report also predicts the impacts of numerous alternative future investment levels on a variety of condition and performance indicators.

If investment were to remain at 2002 levels in constant dollar terms, it is projected that recent trends observed in the conditions and performance of the highway system would continue. At this range of investment levels, and assuming current tax and fee structures for system users, the operational performance of the highway system is expected to further deteriorate: average speeds would decline and the amount of delay experienced by drivers would increase. Recent trends toward improvements in bridge conditions are expected to continue; however, the aging of the Nation's bridges, particularly on the Interstate System, will present additional challenges in the future.

Composition of Future Investments

The analyses of future investment requirements in this report suggest that (1) there is substantial room for cost-beneficial investment in system preservation that would reduce average highway user costs and (2) the most effective mix of investments at the funding level reflected in the "Cost to Maintain Highways and Bridges" scenario would include a higher percentage for system preservation than is currently the case. However, the analyses also suggest that, if funding levels were to be raised significantly, an increasing number of potential system capacity investments would be among the most cost-beneficial options. Such investments are generally more expensive than preservation improvements, but proportionally more of them could be justified at higher funding levels. Thus, the "Maximum Economic Investment for Highways and Bridges" scenario would devote a larger share of total investment toward capacity expansion than would the "Cost to Maintain" scenario.

Conclusion

Since the enactment of TEA-21, combined Federal, State, and local investment in highway infrastructure has increased substantially. This investment led to improved highway and bridge conditions, particularly on higher-order functional systems. Despite record levels of funding, however, congestion increased throughout

the country. Analysis of highway and bridge needs and investment requirements suggests that, while devoting a larger share of investment toward system preservation would be more cost beneficial at current funding levels, future increases in investment might best be oriented more toward system expansion to reduce user costs and enhance system performance.

Highlights: Transit

Record levels of Federal investment in transit under TEA-21 were not only matched, but exceeded by the combined investments of State and local governments from 1997 through 2002. Total funding by Federal, State, and local governments reached its highest level of $26.6 in 2002, a 52.2 percent increase in current dollars from $17.5 billion in 1997, equal to 40.0 percent increase in constant dollar terms. Federal funding in current dollars increased by 32.8 percent, from $4.7 billion in 1997 to $6.3 billion in 2002, equal to a 22.2 percent increase in constant dollar terms. State and local funding in current dollars increased by 59.4 percent, from $12.7 billion in 1997 to $20.3 billion in 2002, equal to a 46.7 percent in increase in constant dollar terms. Total funding for transit, including system-generated revenues, increased by 40.6 percent from $26.0 billion in 1997 to $36.5 billion in 2002, an increase of 29.3 percent in constant dollars.

In 2002, total transit agency expenditures for capital investment were $12.3 billion in current dollars, accounting for 34.9 percent of total transit spending. Federal funds provided $5.0 billion of total transit agency capital expenditures, State funds provided $1.4 billion, and local funds provided $5.9 billion. Capital investment funding for transit from the Federal government increased by 20.7 percent from 1997 to 2002, and capital investment funding for transit from State and local sources increased by 108.9 percent from 1997 to 2002. Due to the sharp increase in transit capital funds from State and local sources, the Federal government's portion of total transit capital investment from all levels of government fell from 54.7 percent in 1997 to 47.2 percent in 2000 to 40.6 percent in 2002.

Transit Infrastructure Has Expanded

The significant growth in total capital investment under TEA-21 is reflected in an expansion of the National transit infrastructure. Between 1997 and 2002, the number of active urban transit vehicles as reported to the National Transit Database increased by 12.0 percent, from 102,258 to 114,564. Track mileage grew by 8.1 percent, from 9,922 miles in 1997 to 10,722 miles 2002. The number of stations increased by 6.8 percent, from 2,681 in 1997 to 2,862 in 2002; and the number of urban maintenance facilities increased by 5.5 percent, from 729 in 1997 to 769 in 2002.

Transit Use Has Increased

With new and modernized transit vehicles and facilities, passenger use has also increased, particularly transit rail use. Passenger miles traveled (PMT) on transit increased by 14.3 percent, from 40.2 billion in 1997 to 45.9 billion in 2002. PMT on nonrail transit (primarily buses) increased by 12.0 percent, from 19.0 billion in 1997 to 21.3 billion in 2002. PMT on rail increased by 16.5 percent from 21.1 billion in 1997 to 24.6 billion in 2002. The distance traveled by all transit vehicles in revenue service, adjusted for differences in carrying capacities, increased by 15.7 percent, from 3.6 billion full-capacity bus miles in 1997 to 4.2 billion equivalent miles in 2002.

Physical Conditions For Most Assets Have Improved

Bus and rail vehicle conditions have improved since 1997. On a rating of 1 (poor) to 5 (excellent), bus vehicle conditions increased from 2.94 in 1997 to 3.19 in 2002. Rail vehicle conditions were about the same, 3.42 in 1997 compared with 3.47 in 2002, although they were somewhat lower in the intervening years.

Bus facility conditions improved from 3.23 in 2000 to 3.34 in 2002. Average condition is not available for 1997. Sixty-eight percent of bus maintenance facilities were in adequate (3) or better condition in 2002 compared with 71 percent in 2000 and 77 percent in 1997. However, the percent in poor condition fell from 5 percent to 1 percent, affecting the condition average. Rail facility conditions improved from 3.20 in 2000 to 3.56 in 2002. As with buses, average condition is not available for 1997. Eighty percent of rail facilities were estimated to be in adequate or better condition in 2002, compared with 64 percent in 2000 and 77 percent in 1997. (These vacillations result from changes in facility deterioration schedules between 1997 and 2000 and asset inventory information collected between 2000 and 2002.) The conditions of track and structures improved. Changes in the conditions of power systems were mixed depending upon the specific asset type. The conditions of stations and yards declined. Nonrail stations are, on average, in better condition than rail stations. The changes in the condition of nonvehicle assets reflect both actual changes and changes based on new information. Almost half of the nonvehicle transit asset data used by FTA to estimate conditions has been updated since the last report as a result of information collected by FTA directly from transit agencies.

Operational Performance, Mixed Results

Vehicle utilization is a measure of service effectiveness and vehicle crowding. Between 1997 and 2000, vehicle utilization rates increased for commuter rail, heavy rail, light rail and ferry boat and decreased for all other modes. Vehicle utilization rates for all modes decreased from 2000 to 2002.

Average vehicle speed as experienced by passengers declined from 20.5 miles per hour in 1997 to 19.6 miles per hour in 2000, increasing to 19.9 miles per hour in 2002. Rail speed declined from 26.1 miles per hour in 1997 to 24.9 miles in 2000 increasing to 25.3 miles per hour in 2002. Nonrail speed declined from 13.8 miles per hour in 1997 to 13.7 miles per hour in 2000 and 2002.

Future Investment Scenarios

The estimated average annual "Cost to Maintain" transit asset conditions and operating performance is estimated to be $15.5 billion, 26.8 percent more than 2002 capital spending. Between 45 to 68 percent of these projected funding requirements are for asset rehabilitation and replacement. Asset rehabilitation and replacements accounts for a larger portion of total investment requirements if performance is maintained and a smaller portion if performance is improved. These increased investment requirements reflect an enlarged transit infrastructure base, new information collected on transit assets from field surveys and data provided to FTA by transit agencies, updated capital cost estimates, and a downward revision in the average condition of rail vehicles as a result of improvements to deterioration schedules.

Eighty-seven percent of transit investment requirements are expected to be in urban areas with populations over 1 million, which is not surprising given that 91.6 percent of PMT on transit systems are in these areas. Fifty-eight percent of the total amount needed to maintain conditions and performance, or $9.0 billion dollars annually is estimated to be for rail infrastructure. Vehicles account for the highest proportion, but less than half, of projected capital outlays for both rail and nonrail modes. Changes in investment needs by asset type from 2000 to 2002 varied considerably. The most notable change was an increase in the amount

needed for stations and a decrease in the amount needed for guideways. These changes principally reflect new data collected since the last report.

The average annual "Cost to Improve" both the physical condition of transit assets and transit operational performance to targeted levels by 2022 is estimated to be $24.0 billion in constant dollars, 95.1 percent higher than transit capital spending of $12.3 billion in 2002. This scenario is an upper limit of the economically justifiable level of transit investments. The scenario assumes that all assets reach an average level of 4 by the end of the investment period Eighty-four percent of the additional amount for the "Cost to Improve," or $6.6 billion annually, is for performance improvements to increase average operating speeds as experienced by passengers and lower average vehicle occupancy levels to threshold levels by 2022, by undertaking investments in systems with slower passenger speeds and higher occupancy rates.

Projected investment requirements are sensitive to forecasts of PMT. The estimated investment requirements presented in this report are based on an average annual increase in ridership of 1.5 percent, an average of transit travel forecasts from 76 metropolitan planning organizations (MPOs). The previous report used projected growth of 1.6 percent per year based on the forecasts of 33 MPOs. The projected rate is above the actual 0.9 percent average annual rate of growth between 2000 and 2002, but below the actual average annual growth of 2.7 percent occurring between 1993 and 2002. Transit travel between 2000 and 2002 was affected by a 0.7 percent average annual decline in passenger miles traveled on heavy rail, reflecting a drop in New York City ridership following the September 11, 2001 terrorist attacks.

Conclusion

Increased Federal funding for transit capital investment under TEA-21, combined with a substantial increase in State and local government funding, has expanded transit infrastructure and permitted the condition of most transit assets to be maintained or improved between 1997 and 2002. Passenger miles traveled have increased substantially from 1997 to 2002, but more gradually between 2000 and 2002 than in the preceding 3 years. Vehicle utilization rates for all nonrail modes were lower in 2002 than in 1997; utilization rates for commuter rail, heavy rail and light rail were higher in 2002 than in 1997. Vehicle speeds as experienced by passengers declined from 1997 to 2002, but were slightly higher in 2002 than in 2000. The amount to maintain conditions and performance has increased very slightly since the last report; the amount to improve conditions and performance has increased by more. The larger increase in the amount to improve conditions and performance has resulted principally from upward revisions, on average, in rail capital costs, coupled with a shift in capital investment from bus to rail, assumed by the improve scenario. Since the last report, FTA has undertaken two major studies updating light and heavy rail capital cost information.