Airside Expansion at Lambert Field

The Blues in St. Louis

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Introduction and Motivation

Lambert-St. Louis International Airport experienced a dramatic decrease in passenger traffic at the beginning of the new millennium. The annual passengers reached an all-time peak at 30.6 million in the year 2000, then dropped to a twenty-year low at 13.4 million in 2004. This was a 56.2% decrease in traffic over a period of 4 years!

At the same time, a new 9,000 ft. runway was built at Lambert. The runway project cost just over $1 billion, and required destroying almost half of the City of Bridgeton, displacing over 5,000 local residents. This in turn led to controversies and even lawsuits between the City of Bridgeton and the City of St. Louis as the local communities faced off against the interests of the larger metropolitan region. The interests of the airports clearly dominated, and the runway project took only 8 years from initial planning to public opening.

These changes at Lambert bring up an obvious question: why the mismatch of supply and demand?

Brief History of St. Louis

St. Louis was first settled on the west bank of the Mississippi River in 1764. After the first several decades of settlement, St. Louis was incorporated as a city in 1822. Growth in St. Louis boomed until the Civil War, and it was one of the nation’s largest cities well into the late 1800s. The city’s early growth was largely due to river traffic on the Mississippi, and St. Louis had the second largest port in the country in 1850 (the largest was New York City).

Competition with Chicago has been a defining feature in the history of St. Louis. The railroads reached the Mississippi River from the east around 1850. Shortly afterwards, railroad networks were constructed to the West. However, no link existed between these East and West networks since no bridge had been built yet to span the Mississippi. Passengers and cargo traveling by train from east to west would have to cross the river by ferry at St. Louis. Although St. Louis seemed a natural place to build a railroad bridge, the long-standing riverboat industry in St. Louis delayed these plans.

The battle between river-based North-South traffic and rail-based East-West traffic intensified, and several lawsuits reached the US Supreme Court in which steamboat owners sued the railroad companies claiming that bridges were hazards to river navigation. Although the railroad companies were eventually allowed to build bridges across the Mississippi, the steamboat owners had successfully delayed any such bridge in St. Louis for over 20 years! The first bridge to span the Mississippi in St. Louis was not completed until 1874. In the meantime, Chicago had become the major hub for East-West railroad traffic, and St. Louis had lost significant ground in terms of its prominence and regional dominance. By the time the World’s Fair came to St. Louis in 1904 (arguably the most significant event in the city’s history), Chicago had already surpassed St. Louis in importance and had more than triple its population. Thus, although St. Louis is currently a modern city, it has lost its dominant role in the Mid-West to Chicago.

Lambert Field

The origins of Lambert-St. Louis International Airport trace back to what was originally a hot air balloon launching site. Major Charles Lambert bought the airfield in 1920 and subsequently developed it into an airport. When he sold it back to the city in 1928 (for the same price that he paid to initially acquire the land 8 years earlier!), Lambert Field became the first municipally-owned airport in the United States. Site of several other historic events in aviation, Lambert was Charles Lindbergh’s point of departure for his famous journey across the Atlantic in 1927.
Lambert Field started to serve commercial passenger traffic soon after it was bought back by the City of St. Louis, but WWII restrained traffic growth during the middle part of the century. Passenger traffic experienced a dramatic surge in the 1970s, and as a result the airport’s capacity needed to be expanded. Through new terminal facilities and runway extensions, Lambert’s capacity increased by 50% to keep pace with demand.

As the boom continued through the 1980s and 1990s, the Lambert Airport Master Plan called for additional airside expansion. The most recent addition to the airport – runway 11-29 – was approved in 1998, broke ground in 2001, was completed by 2005, and opened for public use in 2006.

**Trans-World Airlines**

TWA traces its roots to a merger between two early airlines in 1930. After WWII, TWA built up a large international network. One of the first airlines to operate an all-jet fleet, TWA was also one of the first airlines to adopt the hub-and-spoke model. TWA moved its primary hub from Kansas City to St. Louis in starting in 1982.

Although TWA was a major international player, it had neglected to develop its domestic routes in the years before airline deregulation in the US. Thus it lost ground to its competitors after deregulation, and financial problems began to develop. Short on capital, TWA sold to Carl Icahn in 1985. However, Icahn ended up breaking off and selling the airline’s most profitable assets to the competition. Thus, TWA was forced to declare bankruptcy in 1992.

Although Icahn was ousted in 1993, he managed to maintain a stranglehold on the airline. As part of the deal to leave TWA, Icahn maintained the option to buy highly-discounted tickets through another company he controlled (Karabu) for a period of 99 months. He pursued this option and ended up buying TWA tickets through Karabu and selling them to travel-agents and passengers. Although TWA sued Icahn and Karabu claiming that the ticket agreement did not allow for resale to the general public, the case was dismissed and Icahn was allowed to continue selling the tickets he acquired through Karabu. Thus Icahn ended up taking a significant portion of TWA’s revenues after he left the company, while TWA continued to incur all of the operating costs. As a result of the Karabu deal, TWA was forced into a second bankruptcy in 1995.

After the airline restructured its operations in the late 1990s, it experienced a short turnaround. However, as financial problems resurfaced around the new millennium, TWA was sold to American Airlines in 2001 and declared bankruptcy for a third time as part of the acquisition.

**Traffic Collapse**

After American Airlines bought TWA, it quickly decided to scale back hub operations in St. Louis. With large hubs already in place in Chicago and Dallas, American didn’t need the large St. Louis operation. In an ironic move considering the rivalry between St. Louis and Chicago, American Airlines diverted many of the passengers that connected through Lambert to its O’Hare hub, as well as to Dallas/Ft. Worth. In 2003, American cut flights to St. Louis in half, and in 2005 it only renewed its lease for just over half of the gates it had at Lambert. Since the majority of the travelers that flew threw Lambert were connecting passengers, it was no surprise that traffic through St. Louis plummeted between 2000 and 2004, as shown in the figure below.
Given the dramatic reduction in traffic through Lambert Airport in the new millennium, the new runway project seems unnecessary. The main question to be answered is why was the airside capacity of the airport increased at the same time as passenger traffic experienced such a dramatic collapse? Several alternative explanations may exist.

The first explanation may be that the runway project was the result of bad planning. Incorrect forecasts and inadequate risk analyses may have led airport officials to overestimate the projected demand levels, and thus overstate the need for additional airside capacity. Perhaps planners should have seen the warning signs from TWA before it was finally bought by American and have realized that the future of St. Louis as a hub was highly uncertain.

The second explanation may be that the construction was mistimed. Instead of proceeding with the project at full speed in the midst of the traffic reduction, airport officials could have perhaps delayed construction until traffic through St. Louis recovered from the September 11th attacks and the American Airlines’ buyout of TWA.

A third explanation could be that perhaps Lambert just suffered from bad luck. Despite proper planning and good intentions, airport officials may have been blind-sighted by the unfortunate circumstances that developed.

Finally, it may be the case the Lambert expansion project was fully justified and within the scope of regional and national goals, despite the reduction in traffic. Perhaps there were other motivations besides the demand forecasts that led airport officials to pursue and construct the new runway, or perhaps the outcome of the traffic collapse was within the range of traffic forecasts that the planners used to justify the construction project.

To answer these key questions one must take a deeper look at the airport master plan and the issues that the runway project was meant to address.
Airport Master Plan

The original Lambert Airport Master Plan was developed between 1987 and 1993. In response to the demand trends at the time, it was determined that an expansion of Lambert’s airside capacity was required. The plan consisted of 4 brand new parallel runways, rotated clockwise 10 degrees from the current runway alignment. Construction was to take place while 24-hour operations continued at the airport. However, this initial plan was deemed to be too complicated and costly to pursue.

A Master Plan Supplement study was initiated in 1994 to re-assess the future plans of the airport. The stated goals of the study were to: 1) preserve and enhance Lambert’s role as a critical link in the nation’s air transportation system; 2) strengthen Lambert’s role as a major economic asset as an airline hub; and 3) provide the facilities required to keep Lambert competitive. The key design driver that was identified was the need to provide for dual independent IFR approaches.

The airside layout at Lambert (before the new runway was built) consisted of two close-parallel runways and one intersecting runway. Runways 12L-30R and 12R-30L are 9,000 ft and 11,000 ft long, respectively, and runway 6-24 is 7,600 ft long. However, the centerline displacement between runways 12L-30R and 12R-30L is only 1,310 ft so that Lambert could not accommodate simultaneous IFR approaches. Although the airside capacity of the airport was sufficient in good weather, the capacity was basically cut in half whenever the weather worsened (about 14% of the year in St. Louis). This caused delays both locally for St. Louis flights as well as throughout the national airspace system. The plots below show the capacity envelopes at Lambert between January 2000 and July 2002.
The Master Plan Supplement generated three traffic forecasts against which to compare possible airport development alternatives. These forecasts spanned 20 years into the future, and considered several traffic growth scenarios. The first scenario was a business-as-usual baseline that predicted 42 million annual passengers through St. Louis in 2015. The next scenario assumed higher-than-expected passenger growth due to either increased hub operations by existing carriers or the emergence of a second airline hub at Lambert, and predicted up to 56 million annual passengers in 2015. Finally, the last scenario assumed the loss of the TWA hub in St. Louis, but it also assumed that another airline would eventually replace TWA’s hub, thus predicting 26 million annual passengers in 2015. (Ironically, the actual passenger traffic at Lambert is currently below even this lowest forecast!) However, although three different forecasts were developed, the Lambert-St. Louis International Airport Master Plan Supplement only used the baseline (“middle” forecast) for its cost-benefit analyses.

Development Options

Several capacity expansion alternatives were considered before the construction of runway 11-29. The first of these was the option to develop Scott Air Force Base / Mid-America Airport to relieve Lambert. Scott AFB is located about 19 miles to the southeast of downtown St. Louis in Illinois. However, although Scott AFB is relatively close to the city (Lambert itself is about 12 miles away to the northwest of downtown), the idea to develop the airfield for commercial operations was quickly dropped. Since airline traffic tends to concentrate at existing airports and since airlines compete on frequency in order to maintain market share, a region needs a large enough base of origin-destination passengers (as opposed to
connecting traffic) in order to feed multi-airport system. While the threshold for a second airport is considered to be around 12 million annual originating passengers, the St. Louis region originating passengers were only forecast to reach around 8.7 million in 2015. Therefore, the option of developing Scott AFB for large commercial operations was dismissed.

Nine other alternatives were considered for Lambert's expansion. These alternatives ranged from one resembling the original master plan but with only 3 new runways rotated from the current alignment, to several options that called for building only one new runway to supplement the existing airfield, to a “no-action” alternative that would leave the airfield as is. These alternate options are depicted below.

The CANTED alternative, which required building the 3 new parallel runways while maintaining continuous operations, was quickly dismissed due to the same issues of cost and complexity that were identified with the original master plan. The X-1 “no-action” alternative was also dismissed because it would not meet the needs and goals that the Master Plan Supplement was meant to address.

Among the remaining alternatives, the airport planners had to weigh the costs of acquiring new land beyond the airport boundaries, relocating facilities already in place on the airfield (such as the McDonnell-Douglass manufacturing plant and the Missouri Air National Guard), the impacts on the environment surrounding the airport, as well as the costs of the runway construction itself, against the savings due to the increased operational efficiency in bad weather. Some of these comparisons are shown in the tables below, taken from the Master Plan Supplement.

The final two alternatives under considerations were the W-1W and the S-1 options. Although the S-1 alternative would have achieved shorter taxi times by placing the new runway closer to the terminal than the W-1W option, the S-1 plan would have involved the construction of taxiway bridges over interstate I-70. It would have also displaced more people and affected more of the neighboring communities, as
shown below. In the end, the higher cost of the S-1 option outweighed the incremental savings of the shorter taxi times, so alternative W-1W was chosen.
The W-1W development alternative required building a new 9,000 ft by 150 ft runway parallel to the existing runways but farther to the west (on the west side of runway 6-24). The new runway was placed so that it has a 4,100 ft centerline displacement from runway 12L-30R, allowing for dual independent IFR approaches on the outer runways with the use of the Precision Runway Monitor (PRM) which had already been installed at Lambert. The threshold of the new runway was displaced by about 12,000 ft because it had to be built to the west of the existing airfield. Alternative W-1W also included the option of extending runway 12R-30L 2,500 ft to the northwest if required, as well as the construction of the associated taxiways. The Master Plan Supplement projected the airside capacity to increase from 97 to 131 movements per hour after the completion of the new runway. The FAA Capacity Benchmark Report shows slightly higher average hourly rates, from 103 before to 146 after the expansion (below).

<table>
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<tr>
<th>Weather</th>
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<tr>
<td>Optimum Rate</td>
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<td>Dual simultaneous visual or LDA approaches, visual separation</td>
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<td>Arrivals on Runways 30L (new), 30R, Departures on 30L (new), 30R,</td>
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<td>Planned improvements (2013), Including new runway</td>
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<td>Marginal Rate</td>
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<td>Planned improvements (2013), Including new runway</td>
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<td>Simultaneous instrument approaches, radar separation</td>
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<td></td>
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<td>Planned improvements (2013), Including new runway</td>
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The W-1W project required the acquisition of almost 1,600 acres, including about 2,300 households and displacing 5,680 local residents. The land use plan (above) shows that while most of the property acquisition is for the airside facilities (runways and taxiways) themselves, additional land around the airport is needed for noise mitigation (and will thus be used for airport supporting facilities). In order to level the terrain for the new runway and taxiways, 18.3 million tons of soil had to be moved. However, the project remained soil-neutral as all the soil moved from one part of the development site to another. The expansion project also included the construction of the first automobile tunnel in the state of Missouri, since the new runway had to cross Lindbergh Road, a major traffic artery in St. Louis.

The new runway was expected to reduce operational delay by 63% in 2005, 65% in 2010, and 66% in 2015 at Lambert, and by 5% in 2005, 8% in 2010, and 14% in 2015 for the National Airspace System. Passenger delay at Lambert was projected to decrease by 55% in 2005, 52% in 2010, and 57% in 2015. These numbers are from the Master Plan Supplement, and they are slightly different from those in the Capacity Benchmark Report. Airside capacity is forecast to increase 34% in good weather and 63% in bad weather. These delay reductions translated into an estimated savings of $100 million in 2005 and $300 million in 2015.

Although the new runway was built to increase airside capacity in inclement weather, the noise impacts of Lambert Airport on the surrounding communities were projected to decrease. However, this was mostly due to the fact that stricter noise regulations were expected to decrease the noise produced by the average aircraft operation, so the noise reduction can hardly be attributed to the expansion project itself. Local air quality, however, was projected to improve directly because of the new runway. Since the new runway would reduce delays, aircraft would spend less time burning fuel on the ground, so average emissions per operation were expected to decrease. The only exception to this was NOx emissions, which were estimated to increase slightly.

One of the more unique considerations for the W-1W alternative was the proximity of the new runway to a local landfill. FAA requirements state that no part of an airfield should be closer than 10,000 ft to a landfill, but the northwest end of runway 11/29 falls just under this separation requirement at 9,200 ft. The risk of potential bird-strikes associated with the landfill required mitigation measures, such as asking the landfill operator to fill that part of the landfill closest to the airport first (while the runway was still under construction), and then to cease using portions of the landfill closer than 10,000 ft to the runway.

Finally, the socio-economic impacts of the expansion project were also included in the cost-benefit analysis. On one hand, the expansion significantly reduced the market area for some local businesses and shopping centers. This had a negative effect on the local community. On the other hand, the W-1W expansion injected over $400 million into the regional economy. Design and construction contracts involved about 550 companies, 80% of which were local to the St. Louis region, which created nearly 14,000 jobs.

**Financing**

The Lambert expansion project was funded through several sources. Money came from Airport Development Funds, Federal Highway Administration grants, and Airport Improvement Program grants, as well as from general airport revenue bonds and Passenger Facility Charges. One of the main selling points used by airport officials was that only about one third of the cost of the project were passed on to the airlines. Although the delay reductions would have the most significant and direct impact on reducing airline costs, airport officials sought to make Lambert even more attractive by only passing on a fraction of the costs of the improvements to the airlines.

The overall project budget was $1.059 billion. Almost half of that sum was required just for land acquisition. Another 40% was required for the construction itself, with the remainder of the budget dedicated to management and consulting overhead.
Terminal Expansion

In conjunction with the new runway, a terminal expansion plan was also developed. Although the motivation for the new runway was the crippling effect of bad weather on Lambert operations, the terminal expansion plan was a direct response to the passenger traffic forecasts previously mentioned. Before the expansion project began, Lambert had 89 aircraft gate positions and about 1.5 million square feet of terminal space. The projected future need (in 2015 with the middle forecast) was about 110 total gates. In order to accommodate these new gates, one option was to relocate the Missouri Air National Guard from its location just west of the main terminal to a site on the east side of the airfield, and to build another concourse to the west of the main terminal.

Another option considered was to build a new midfield terminal. This option allowed for more gates (more than the projected need) and thus allowed for easier future expansion. The satellite terminal would have been located between the new runway and runway 12R-30L, as shown below.

This new midfield terminal would have accommodated an additional 150 gates. However, although the option still exists to develop this site, no construction has started on this terminal. Since the demand levels are so far below what was forecasted in 1994, there is no need or justification for the new terminal building. Thus, the terminal expansion plans have been delayed until the passenger demand levels actually require a new terminal building.

Local Tensions

An initial survey conducted by the airport planning officials indicated that local sentiments toward the expansion were fairly balanced: about 34% of residents surveyed were opposed to the project, about 47% were in favor of it, and the rest were indifferent. However, in another survey, about 73% of local residents polled said they would be interested in selling their homes to Lambert Airport.

However, as the planning effort moved forward, increasing local tensions began to develop. In particular, the runway expansion project was to take over (and subsequently level) about half of the City of Bridgeton. Along with displacing several schools and churches, the runway project required relocating the Bridgeton city hall. Understandably, Bridgeton officials put up a fierce fight. The figure below shows the land acquisition required for the W-1W expansion.
As tensions rose between the local communities and the City of St. Louis, several interest groups filed lawsuits to try to stop the construction. The City of Bridgeton sued the City of St. Louis on grounds that it was violating the Constitutional right of the City of Bridgeton to determine how its land should be used. Since the Bridgeton had not zoned the land needed for the runway for airport use, it argued that the City of St. Louis was violating its jurisdiction in attempting to build a runway in Bridgeton. St. Louis countered that in many previous cases, the courts had decided that the needs of a large metropolitan area superseded the needs of a local community. In the end, the court dismissed the case since the FAA had not approved the plans yet, and so no legal basis existed to try the case. The FAA in turn stated that it would not consider possible subsequent lawsuits when making its decision (the scope of the decision was merely whether or not the expansion project would meet its stated goals, and whether the benefits would outweigh the environmental costs), and St. Louis officials assured the local residents that they would be paid fair market price for their homes.

Other groups – the Air Line Pilots Association (ALPA), National Air Traffic Controllers Association (NATCA), the City of Bridgeton, the City of St. Charles, St. Charles County, and Citizens Against Airport Noise (CAAN) – pleaded in a meeting with FAA officials to require a “real-time simulation” for the new runway. They were skeptical of some of the assumptions used by the planning officials when computing the estimated benefits of the new runway, and so they requested that air traffic controllers and pilots actually act out peak-hour operations to see if the projected capacities were feasible. However, the FAA eventually deemed the real-time simulation unnecessary.

Finally, the neighboring City of St. Charles believed there as a conflict of interest since the data used in the Master Plan Supplement came from the same contractor (Greiner) that the FAA used for the Environmental Impact Statement, and since Greiner was paid by the City of St. Louis. However, the FAA argued that since Greiner was only hired for the analysis portion of the expansion project, there was no conflict of interest because Greiner had no stake in the outcome of the FAA’s decision (Greiner could not be hired for the construction, so there was no conflict of interest). The FAA argued that it had chosen to use Greiner for the EIS analyses for the sake of consistency. The City of Bridgeton had previously filed a lawsuit challenging the use of Passenger Facility Charges for noise mitigation since the two noise analyses performed were not consistent. However, the issue of consistency does seem to be a legitimate concern: it seems highly suspicious to hire the same contractor to ensure the analyses give the same results simply because of the risk of inconsistent results. A more thorough approach could be to analyze and try to justify the sources of the differences in the two analyses, as opposed to simply ignoring them and using only one analysis.
However, most interestingly, none of the complaints and tensions between the local residents and airport officials mentioned the demand forecasts. The City of Bridgeton at one point argued that perhaps a different alternative (S-1) should have been selected, in essence shifting the problem onto a different community. The issues that were raised regarding the modeling assumptions all concerned things like operational efficiency and taxi times, not the underlying level of demand that was assumed. Thus it seems that neither the people in charge of the expansion project nor the people fighting against it foresaw the dramatic reduction in traffic that was about to occur.

**Runway Completion**

Despite the tensions with the local communities, runway 11-29 was finally completed in 2005. The first commercial flight landed on runway 11-29 in April of 2006, a mere 8 years after the project had started. Given the intensity of the disputes with the local residents, and the amount of land required to actually develop the new airside facilities, the Lambert expansion project was actually fairly quick. The slogan repeatedly used by airport and city officials was “on-time and on-budget”.

The success of the airside expansion project at Lambert was attributed mostly to the cooperation and teamwork between the various entities involved in the design and construction project. Despite the fact that about 550 companies were involved with the project, as well as St. Louis officials and the FAA, an understanding of the common goals of the project allowed the different parties to collaborate effectively. Instead of quarrelling between companies that could be considered competitors, the various parties were remarkably efficient at working together to identify potential problems and advance the expansion project.

**The Road Ahead**

The situation in St. Louis is now one where supply exceeds demand. The decision to build runway 11-29 was quickly followed by the sharp decrease in traffic. Thus, Lambert currently has excess capacity. In this sense, it is a good location for an airline to set up another hub since the delays associated with Lambert will not be as large as at other, more congested airports.

The following plots compare on-time performance at Lambert-St. Louis to Chicago O’Hare and Dallas/Ft. Worth airports (its competitors in terms of American Airlines hubs). They show that Lambert has outperformed O’Hare and has matched or bettered Dallas/Ft. Worth in terms of on-time performance in recent history. Thus, Lambert makes a good case for another future airline hub. If such a hub were to materialize, traffic through St. Louis might eventually approach the low forecast from the Master Plan Supplement.
Conclusion

After looking at the details of the Lambert-St. Louis International Airport airside expansion, we can begin to draw conclusions about what happened over the past decade. The demand forecast used by the Master Plan Supplement was definitely over-optimistic. With the warning signs of 2 previous bankruptcies by TWA, airport planners should have put more weight on the low “loss of the airline hub” forecast. Thus, some of the benefits of the new runway were probably over-estimated in the Master Plan Supplement.

However, the need for runway 11-29 was actually delay-driven, not demand-driven. Although the levels of demand from the forecast never materialized, the new runway did provide the capability to perform dual independent IFR approaches at Lambert. Again, although the delay cost savings are less than initially projected, there are nonetheless savings that can be directly attributed to the new runway. Thus despite the over-optimistic demand forecast, the construction new runway does seem to have been justified.

With regard to flexible planning, the Lambert officials were indeed responsive to the lower actual passenger traffic than was originally projected. The terminal expansion plans were abandoned after the traffic collapse. Although it is still possible to implement the terminal expansion plans in the future, it would have been wasteful to do so once demand levels dropped. Thus, the part of the Lambert expansion project that was demand-driven was indeed responsive to the drop in demand.

The new runway was probably cheaper to build when it was than it would have been in the future. It is likely that property acquisition costs as well as construction costs would have increased, and so delaying the runway construction would probably have cost more than proceeding as scheduled. Once traffic returns to St. Louis, runway 11-29 will be an invaluable asset. In fact, it may even provide the competitive advantage needed to draw traffic to Lambert. Thus, it seems that despite the strong-armed actions and swift construction in the face of the dramatic downturn in passenger traffic, the new runway at Lambert-St. Louis International Airport was in fact beneficial.
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