Future Projected LRT Ridership Challenges and Recommendations

Recommendation:
That the January 25, 2011, Transportation Department report 2011TD9423 be received for information.

Report Summary

This report provides information regarding future LRT ridership and capacity issues associated with the current Clareview - Century Park line and the new Churchill - NAIT line.

Previous Council/Committee Action

At the June 15, 2010, Transportation and Public Works Committee meeting, the following motion was passed:

> That Administration return to Transportation and Public Works Committee with a report outlining future projected over-capacity LRT ridership challenges and recommendations.

Report

Fall 2010 (Clareview – Century Park)

With the start of university and college, as well as the return to work for many citizens, ridership was heavy. Peak-hour use was measured at 4690 passengers per hour in the AM on the northeast part and 4669 passengers per hour on the south part. The PM peak service was more spread out, peaking at 3397 passengers per hour on the northeast and 4121 passengers on the south. These counts indicated a 7 percent increase in the peak-hour use on the northeast part and a 104 percent increase on the south part of the line over the 2009 ridership figures.

A mixture of four-car and three-car trains were scheduled which required a total of 52 cars in service. Due to restricted fleet availability of the older U2 cars, the planned bookout was reduced from 53 cars to 52 cars operating as 15 trains on 5-minute service during peak-hours. This created passenger load factors of up to 68 percent of the service design capacity in the AM peak.

Within the peak hour service, there were “super” peaks of passengers (crush loads) that filled one to three trains more than the service design load. This caused pass-ups and overcrowding complaints.

However, by spreading out the time period when passengers choose to travel, the peak surges can be smoothed and consistent loads close to the design capacity can be achieved. The service design capacity is defined as 75 percent of a crushload per car.

An education program was implemented to encourage passengers to travel on the earlier and later periods of the peak-hours, to move into the centre part of the car and away from the doorways, and to spread out along the platform to even the load between cars in a train. Passengers responded well to the program. The four-car trains were added in the schedule to match heavy loads within the peak-hour.

A four to five-minute headway was tested in June. This was achieved by adding one three-car train into service which increased the peak capacity by about 5 percent.

However, there were some impacts with the reduction of LRT train headways. At University Avenue and 114 Street, the numbers of skipped East/West phases were reduced, and there were fewer train meets at the crossing which resulted in more extended approach cycles being implemented. This increased the average extended approach time by five seconds. The effect was minor.

At 51 Avenue and 111 Street, the impact was more significant. There was an increased occurrence of only one traffic phase being served between train arrivals. Left-hand turn phases, in all directions, were reduced to the minimum green times. There was an average time increase of ten seconds for any extended approach activation for the train.

February 2011

With completion of the traction power system upgrade on the northeast section of the line, all trains in service will be four-car trains operating five-minute headways during peak-hour service. Design capacity will increase to 7920 passengers per hour. With the current loads, the line will operate at 59 percent of the service design capacity. Issues related to passups during peak service should be minimal with current ridership numbers. At a 5 percent annual growth in LRT ridership during peak, the capacity could provide ten years of growth before five-car trains are required to meet peak ridership demand.

Future Growth on Clareview – Century Park Line

All platforms have been extended to enable operation of five-car trains. The traction power system will be able to handle all five-car trains, as well when the electrification upgrade is completed in 2011. The ultimate peak-hour design capacity will increase to 9900 passengers per hour with all five-car trains operating on five-minute headways.

The current Light Rail Vehicle fleet of 74 vehicles is designed to support service using all four-car train operation. A fleet of 87 vehicles is required to operate all five-car trains from Century Park to Clareview.

From the Regional Transportation Model, peak-hour ridership in 2041 is projected to be 5690 passengers per hour on the northeast section, and 7600 on the south section in the AM peak. In the PM peak, ridership is estimated to be 5410 passengers per hour on the northeast section, and 7700 on the south section. The Model assumes only an average 2 percent annual growth rate in peak-hour ridership over the next 30 years. All five-car trains operating on five-minute headways will have loads of 78 percent of the service design capacity over that period of time. However, if ridership growth is significantly higher (i.e. 15 percent annually), then the ultimate design

capacity could be reached in as little as 5.3 years.

To cover potential capacity issues, up to ten additional cars may be recommended for purchase in 2015 to enable operation of a mix of four and five-car trains on the existing line starting in 2018. The lead time for delivery of the first of an order of LRT vehicles is 28 - 36 months depending on the production line situation at the time of order. All five-car train operation is necessary by 2025 to handle demand based on an annual 5 percent passenger growth rate.

Future Expansion Churchill - NAIT Line

The NAIT LRT line is scheduled to open in 2014 with an estimated peak ridership of 1650 passengers per hour. This service requires as a minimum, two-car trains operating on ten minute headways. The line will open operating at 83 percent of service design capacity. The ridership model projects a 2041 peak-hour ridership of 3990 passengers per hour which can be met by operating three-car trains on five-minute service.

It is expected that significantly higher growth (5 -10 percent range) in peak service will occur once this line is open, similar to the experience on the South LRT extension to Century Park. That level of growth means the service design capacity will be reached within two to four years after opening.

In order to avoid a failure to meet the service demand, an additional ten cars be ordered immediately to provide the extra capacity. An immediate purchase at a good price is possible now by exercising the current option with our current Light Rail Vehicle car provider to purchase an additional ten SD160 Light Rail Vehicle's in Spring 2011. Staff have been able to get a hold on the option until at least the end of January 2011. An additional eight cars may also be recommended for purchase in 2016 to enable three-car trains to operate on five-minute headways.

Significant factors not included in the regional model include the potential impact of the Downtown arena, NAIT student pass program and the linkage of two major hospitals and another major shopping centre.

In the future, the NAIT line will be extended to St. Albert with the regional model projecting 2041 peak-hour ridership of 5380 passengers per hour in the AM peak and 4140 in the PM peak. The ultimate capacity of five-car trains on five-minute service will operate at 54.3 percent of service design capacity with a 0.5 percent average growth rate assumed over the 30 years.

A total of 69 Light Rail Vehicles are required to service this line when operating five-car trains on five-minute headways. With the initial extension to St. Albert, 24 cars need to be purchased to enable three-car trains to operate on five-minute headways.

Other Extensions Affecting Ultimate High Floor Fleet Size

The ultimate fleet required to provide five-car trains operating on five-minute peak service is 201 vehicles. This includes extensions of the line to 195 Avenue in the Northeast and to 41 Avenue SW in the Heritage Valley area. There will be a need for 22 cars to be purchased when the line is extended to 195 Avenue and 23 cars to be purchased for the extension to 41 Avenue in Heritage Valley.

A summary of the impacts of ridership growth and estimated time to achieve design capacity with various annual growth rates is contained in Attachment 1.

One of the impacts of operating the ultimate high floor fleet is that operations, maintenance and repair facilities will be required in the South and the Northwest areas of the city as those extensions are built. The current D.L. MacDonald facility will be at capacity with the current fleet and additional cars for the NAIT extension.

LRT Over-Capacity Options and Issues

Once the ultimate design capacity of the line is reached, there are a number of ways to improve capacity - increase the frequency of operation (decrease the headway), increase the length of the train, routinely load the trains to crushload capacity in peak-hours, or supplement the LRT capacity with buses.

Increasing the number of trains affects automobile traffic at level-grade crossings and the capacity of the tunnel in the city centre.

Increased frequency of trains may reduce the ability of traffic to get through the intersection.

With the NAIT line and Century Park/Clareview line both operating on five-minute service, the tunnel section through the Downtown area will be operating at two and half minute headways which is the maximum capacity for driver-operated trains without special signalization.

Bus service can be added in parallel to the LRT line during “super” peak periods to provide extra capacity. However, this increases congestion on the supporting road network.

We would use normal budget processes by bringing forward any funding requests.

Policy

City of Edmonton Strategic Plan 2009-2018: Shift Edmonton’s Transportation Mode.

Attachments

1. LRV Growth and Fleet Capacity - 2010 Estimates

LRV Growth and Fleet Capacity - 2010 Estimates

Level of Peak Service	Line Design Capacity	Crushload Capacity	Required Fleet Size	Baseline Peak Ridership	% of design capacity	2041 Projected Ridership	2041 Projected Ridership % of Design capacity	2041 Projected Average Annual Growth Rate %		Years to Reach Design capacity from Baseline		
Existing Line									2% Annual Growth	5% Annual Growth	10% Annual Growth	15% Annual Growth
2010 - 52 cars on 5 minute headways	6864	9152	74	4690	68.33%	7700	112.18%	2.14%	19.4 years	7.8 years	4 years	2.7 years
2011 - 60 cars on 5 minute headways (all 4 car trains)	7920	10560	74	4690	59.22%	7700	97.22%	2.14%	26.4 years	10.8 years	5.5 years	3.75 years
Ultimate Design Capacity - 5 car trains on 5 minute service	9900	13200	87	4690	47.37%	7700	77.78%	2.14%	37.8 years	15.3 years	7.85 years	5.35 years
195 Ave Extension												
Ultimate Design Capacity - 5 car trains on 5 minute service	9900	13200	109	4690	47.37%	7700	77.78%	2.14%	37.8 years	15.3 years	7.85 years	5.35 years
41 Ave SW Extension												
Ultimate Design Capacity - 5 car trains on 5 minute service	9900	13200	132	4850	48.99%	7700	77.78%	1.96%	36.1 years	15 years	7.7 years	5.1 years
NAIT Line												
2014 - 2 car trains on 10 minute service	1980	2640	10	1650	83.33%	3990	201.52%	4.73%	9.5 years	3.8 years	2 years	1.3 years
Ultimate Design Capacity - 3 car trains on 5 minute service	5940	7920	28	1650	27.78%	3990	67.17%	4.73%	59 years	26.5 years	13.5 years	9.3 years
St. Albert Extension												
Ultimate Design Capacity - 5 car trains on 5 minute service	9900	13200	69	4650	46.97%	5380	54.34%	0.52%	38 years	16 years	8 years	5.5 years
Maximum High Floor LRV Fleet	**201**											