INTRODUCTION

SE Group was retained by Franconia Notch State Park/Cannon Mountain to conduct a capacity analysis for the Aerial Tramway and the related skiing terrain at Cannon Mountain. The goal of this exercise is to assist in the evaluation of the impact of replacing the tram with an upgraded tram or with a gondola, by providing data related to the potential changes of skier capacity and density on the terrain served by the lift and the demand on associated guest services at the top and bottom terminals. Equally important, if not more important, is the summer use of the tram and the summit facilities. Summer use is also analyzed.

Cannon Mountain was the site of the first passenger aerial tramway in North America. The original tramway was built in 1938 and was in service for 42 years until 1980 when it was replaced with the tramway currently in use. After another 42 years of near-constant use, the lift is again in need of replacement. The tramway is operated most days of the year, with heavy summer and fall use, in addition to the winter ski operation. There is a very strong sense of identity for Cannon, and FNSP in general, with the aerial tram – there is a long history and legacy of the tram in that location

UPGRADE STATISTICS

Two options were analyzed for replacing the tram: upgrading to a new, slightly higher capacity tram, and replacing the tram with a gondola. The tram upgrade would involve reusing much of the machinery that is in place now, in particular the buildings at the top and bottom terminals there the tram cabins land. Since the existing tram docks would continue to be used, there would not be a possibility of using much larger tram cars. The cars could be sized up to hold 75 people each, and an increase in speed could allow for an additional tram lap per hour, increasing the hourly capacity. For the gondola option, new terminals would be built, trying to use as much of the loading docks as possible. In terms of hourly capacity, gondolas have the ability to go much higher than trams do, but the capacity of the ski terrain would limit the potential hourly capacity in the winter, and the capacity of the summit facilities and trail would limit the potential in the summer. Using these two factors, an hourly capacity of 1,500 people was determined for the gondola. The following tables address the Comfortable Carrying Capacity and ski terrain density analysis for each option.

Cannon Mountain (Main Mtn Only) - EXISTING CONDITIONS
Comfortable Carrying Capacity

Map Ref.	Lift Name, Lift Type	Slope Length (ft.)	Vert. Rise (ft.)	Actual Capacity (persons/hr.)	Adjusted Hrly. Cap. (persons/hr.)	VTF/Day (000)	Vertical Demand (ft./day)	CCC (guests)
A	Tramway / T70	5,289	1,990	525	499	7,445	16,716	460
B	Zoomer /C3	1,588	600	1,800	1,620	7,290	14,891	490
C	Eagle Cliff / C3	2,460	540	1,800	1,440	5,832	9,001	650
D	Peabody Express / DC4	5,251	1,318	2,400	2,040	20,165	18,103	1,010
E	Cannonball / C4	2,528	880	2,100	1,680	11,088	18,098	610
Total:		17,116		8,625	7,279	51,820		3,220

Cannon Mountain (Cannon Side Only) - UPGRADED TRAM
Comfortable Carrying Capacity

Map Ref.	Lift Name, Lift Type	Slope Length (ft.)	Vert. Rise (ft.)	Actual Capacity (persons/hr.)	Adjusted Hrly. Cap. (persons/hr.)	VTF/Day (000)	Vertical Demand (ft./day)	CCC (guests)
A	Tramway / T75	5,289	1,990	640	608	9,074	17,139	530
B	Zoomer /C3	1,588	600	1,800	1,620	7,290	14,891	490
C	Eagle Cliff / C3	2,460	540	1,800	1,440	5,832	9,001	650
D	Peabody Express / DC4	5,251	1,318	2,400	2,040	20,165	18,103	1,010
E	Cannonball / C4	2,528	880	2,100	1,680	11,088	18,098	610
Total:		17,116		8,740	7,388	53,449		3,290

Cannon Mountain (Main Mtn Only) - GONDOLA
Comfortable Carrying Capacity

Map Ref.	Lift Name, Lift Type	Slope Length (ft.)	Vert. Rise (ft.)	Actual Capacity (persons/hr.)	Adjusted Hrly. Cap. (persons/hr.)	VTF/Day (000)	Vertical Demand (ft./day)	CCC (guests)
A	Gondola	5,289	1,990	1,500	1,125	16,791	28,137	600
B	Zoomer /C3	1,588	600	1,800	1,620	7,290	14,891	490
C	Eagle Cliff / C3	2,460	540	1,800	1,440	5,832	9,001	650
D	Peabody Express / DC4	5,251	1,318	2,400	2,040	20,165	18,103	1,010
E	Cannonball / C4	2,528	880	2,100	1,680	11,088	18,098	610
Total:		17,116		9,600	7,905	61,166		3,360

Ski Terrain Density Analysis

Cannon Mountain (Main Mtn Only) - EXISTING CONDITIONS

Density Analysis

		Guest Dispersement				Density Analysis				
Lift Name, Lift Type	CCC	Support Fac./Milling (guests)	Lift Lines (guests)	On Lift (guests)	On Terrain (guests)	Terrain Area (acres)	Terrain Density (guests/ac.)	Target Trl. Density (guests/ac.)	Diff. (+/-)	Density Index (%)
Tramway / T70	460	115	125	67	153	43.3	4	7	-3	57%
Zoomer /C3	490	123	81	101	185	17.9	10	10	0	100%
Eagle Cliff / C3	650	163	72	131	284	19.0	15	15	0	100%
Peabody Express / DC4	1,010	253	102	179	476	36.8	13	12	1	108%
Cannonball / C4	610	153	84	167	206	25.5	8	10	-2	80%
Total:	3,220	807	464	645	1,304	142.4	11	11	0	96%

Cannon Mountain (Cannon Side Only) - UPGRADED TRAM

Density Analysis

		Guest Dispersement				Density Analysis				
Lift Name, Lift Type	CCC	Support Fac./Milling (guests)	Lift Lines (guests)	On Lift (guests)	On Terrain (guests)	Terrain Area (acres)	Terrain Density (guests/ac.)	Target Trl. Density (guests/ac.)	Diff. (+/-)	Density Index (%)
Tramway / T75	530	133	152	27	218	43.3	5	7	-2	71%
Zoomer /C3	490	123	81	101	185	17.9	10	10	0	100%
Eagle Cliff / C3	650	163	72	131	284	19.0	15	14	1	107%
Peabody Express / DC4	1,010	253	102	179	476	36.8	13	12	1	108%
Cannonball / C4	610	153	84	167	206	25.5	8	10	-2	80%
Total:	3,290	825	491	605	1,369	142.4	11	11	0	98%

Cannon Mountain (Main Mtn Only) - GONDOLA

Density Analysis

		Guest Dispersement				Density Analysis				
Lift Name, Lift Type	CCC	Support Fac./Milling (guests)	Lift Lines (guests)	On Lift (guests)	On Terrain (guests)	Terrain Area (acres)	Terrain Density (guests/ac.)	Target Trl. Density (guests/ac.)	Diff. (+/-)	Density Index (%)
Gondola	600	150	56	99	295	43.3	7	7	0	100%
Zoomer /C3	490	123	81	101	185	17.9	10	10	0	100%
Eagle Cliff / C3	650	163	72	131	284	19.0	15	15	0	100%
Peabody Express / DC4	1,010	253	102	179	476	36.8	13	12	1	108%
Cannonball / C4	610	153	84	167	206	25.5	8	10	-2	80%
Total:	3,360	842	395	677	1,446	142.4	11	11	0	99%

As can be seen in the tables on the past two pages, the increase to the hourly capacity of the upgraded tram results in a small increase to the CCC of the tram, which results in about a 10% increase in the density index for the ski terrain associated with the tram, but is still well below the target density. The increase in hourly capacity from the gondola significantly affects the CCC of the lift. Note that there are other factors in play in this calculation, such as the reduced lift line wait time, and the increased number of possible repeat ski laps per day, resulting in higher vertical demand. As stated, the hourly capacity of 1,500 people was chosen to match with the terrain capacity. At a higher hourly capacity, the terrain densities would be too high. The resulting CCC for that lift would be about a 140 people higher than the tram. This is largely due to the continuous nature of the gondola – there is no wait time for a cabin to come along on a gondola, there is always one available. The calculated average round-trip time is about 35 minutes on the tram, as compared to about 20 mins on a gondola – due to the waiting time for the next tram cabin.

Summer Capacity

In looking at the capacity of the summit facilities and trails, there are a few different methods that can be used.

Method #1 - PAOT (people at one time) technique.

On lift	70
In line	125
In restaurant	210
On trail	57
Observation deck	19

Using this technique, there are 480 people using the facility at once. Assuming a four times turn-over (8 hour day, plus 2 hour total stay – including parking, waiting, tickets, souvenirs, and summit time), that gives a daily capacity of 1,900 or so.

Method #2 – The through-put method

This method uses an hourly capacity multiplied by open hours, then divided by the average length of stay, multiplied by a utilization rate divided by the active time percent. This is a calculation commonly used in the recreation industry. If you use 280 pph*8 hr day/2 hr stay*80% utilization/50% active time – that gives a result of 1800 or so people.

Method #3 – simple tickets sold. If we assume 70 people (tickets) sold every 15 mins for 8 hours of operation, that is 2,240 people.

All of those numbers are relatively similar, so are telling a similar story – a total summer daily capacity of somewhere around 2,000 people. The PAOT calc is pretty useful in terms of determining how many people are at the overall facility at once (480) and how many are on the summit at once (285). So, it would take about four trams to completely fill the summit in the morning, then that number would stay static (assuming roughly the same number of people are going down each tram), then would need to start decreasing an hour before closing.

Summit Restaurant Capacity

The capacity of the summit building restaurant/guest service space is another important factor. The following table details the existing amount of space, with a comparison to industry averages for each function.

Cannon Mountain (Main Mtn Only) - EXISTING CONDITIONS
4. Industry Average Space Use
Summit Building/Mountain Station

Service Function	Existing Total	Recommended Range	
		Recommended Low Range	Recommended High Range
Ticket Sales/Guest Services	-	-	-
Public Lockers	-	-	-
Rentals/Repair	-	-	-
Retail Sales	-	-	-
Bar/lounge	-	-	-
Adult Ski School	-	-	-
Kid's Ski School	-	-	-
Restaurant Seating	2,188	3,010	3,680
Kitchen/Scramble	750	950	1,160
Rest rooms	526	560	680
Ski Patrol	1,072	340	420
Administration	-	-	-
Employee Lockers/Lounge	-	-	-
Mechanical	1,192	130	200
Storage	190	220	330
Circulation/Waste	1,046	520	780
TOTAL SQUARE FEET	6,964	5,730	7,250

As the table shows, there is an existing shortage of restaurant seating space, kitchen space, and rest room space. While there are surpluses of the other categories, those are the most guest-facing areas, so the shortages in those areas are felt the most by the guests. Those shortages would be felt even more acutely with a larger capacity.

Summit Restaurant Seating Capacity

Cannon Mountain (Main Mtn Only) - EXISTING CONDITIONS
6. Recommended Restaurant Seats

	Summit Building/ Mountain Station
Lunchtime Capacity (CCC)	955
Average Seat Turnover	3.5
Existing Indoor Seats	169
Existing Outdoor Seats	122
Required Seats	273
Difference	-104
Existing seating capacity - indoor only	592

Existing seating capacity - including outdoor	1,019

As the table shows, there is sufficient seating if the outdoor deck seating is included. There are not many winter days when the outdoor seating is usable due to the weather conditions. In the summer, the seating is used all day long, with greater turnover rate than 3.5 times. Overall, there is a shortage of seating both in the winter and summer. Again, this would be even more of an issue if the capacity were increased significantly.

Considerations on Winter/Skiing Use of the Tram

The tram is not a big component of skiing at Cannon – tram laps are more of a novelty than anything else. Only approximately 10% of skiers on any given day are on the tram. The chairlift system is far more efficient for skiing – more direct access to the terrain and the ability to get more skiing in. The low use of the tram is largely due to two factors:

1. The location of the bottom terminal is not well situated for skiing. The bottom terminal is not at the bottom of most of the skiing, it requires taking a specific path to get to the bottom of the tram – it requires pre-planning to get there. Furthermore, there is no good novice route to the bottom of the tram. The only route is to take the Tram Cutback and Banshee Cut-Thru – this is a difficult and challenging route for novice skiers. There also isn't any novice terrain available off the summit. The tram is difficult to access and difficult to repeat-ski.

2. Trams are not fundamentally an efficient way to ski a mountain. This is primarily because the number of round trips a skier can make per day is low, due to the wait time for the tram (the tram cars do not show up continuously like chairs do on chairlifts). The calculated average round-trip time is about 35 minutes, as compared to about half that on a chairlift of the same length. This then reduces the total amount of vertical that can be skied in a day. The other factor is the infamous surge phenomena with trams where the skiers come in surges every time a car unloads, so the ski area has to have enough terrain to handle the density of the surge. But then once the surge of skiers is past, there are very few skiers on the runs.

The implication of these factors is that the existing tram alignment is not the place to add lift capacity at Cannon. If hourly capacity was significantly increased in the tram alignment, it very likely still would be underutilized, due to the location issue as discussed above. In fact, there may not be much need to increase lift capacity significantly at Cannon – the lift system capacity is fairly well balanced with the ski run capacity, meaning that if the lift system were significantly increased, there would need to be additional ski terrain as well. Upgrades to the lift system for skiing would be better served by upgrading a few select existing lift: namely upgrading the Zoomer chair to a detachable lift, and possibly looking at higher capacity lifts for Cannonball and Tuckerbrook.

Considerations on Summer Use of the Tram

Tram use is really much more about summer use at Cannon. Riding the tram is the primary summer use at Cannon, and is one of the most popular activities in Franconia Notch State Park – it is truly an iconic attraction. There is a long history and legacy of summer use of the tram in the Notch. The whole tram base area is more heavily used in the summer, and the location by both Echo and Profile lakes is very central to summer use of the Notch (as opposed to the Peabody base, which is less central to

summer use). The summer facilities are well balanced to the current capacity of the tram, and would get overloaded with a significantly higher summer lift capacity.

Thoughts and Conclusions

Based on all of the above, there is no really compelling reason to replace the tram with a gondola for winter/skiing use. Skiing Cannon is not about the tram, and if it were replaced with a gondola, that likely wouldn't change. There would certainly be increased use of it, since the drawbacks of the tram as a ski lift would be taken away, but the location would still be the same – it would still be difficult to access and to repeat-ski.

Additional ticket revenue could certainly be expected with the gondola, as it would functionally increase the daily capacity of the mountain. However, the degree to which that increase could be realized might be dictated more by parking availability and guest service space. There is usually excess parking available at the tram in the winter, so it's possible that some additional capacity could be realized there. If CCC was increased by 150 people, using standard season lengths and average utilization rates that might result in an additional 6,000 annual skier visits.

However, as discussed, the winter use doesn't matter as much in the use of the tram at Cannon. The issue is clearly mostly about summer (and fall) use of the tram. It has been determined that the existing buildings and facilities at the summit are close to their limit for capacity on big summer and fall weekends, so there probably shouldn't be a big increase to hourly (or daily) lift capacity, no matter what lift system is pursued. There then are two questions to be answered:

1. Is a tram or a gondola a better summer attraction? The answer is that there are benefits to both. The tram is more iconic and presents more of a distinct identity (there are lots of gondolas around). The tram allows for the opportunity for the tram operator to speak to and interact with the people riding the tram – this is a part of the experience. The tram is higher off the ground, giving a better view and a more dramatic experience. These are important factors. A gondola would provide continuous capacity – there would be no need to block out entry based on 15 minute arrival times, as the cabins arrive continuously. A gondola allows riders to sit down, which would be preferred by many. The gondola allows for easier viewing in all directions, as the cabin is much smaller and there are immediate views in every direction. Lastly, a gondola would be less expensive to install.

2. Should the state invest in maintaining the tram as a summer/fall attraction? The tram is an integral part of Cannon's identity. The tram is an integral part of Franconia Notch State Park's identity. The tram has a long history of operation in the notch, and is a very popular attraction. For these reasons, SE Group believes that it is important to maintain the experience. While we do believe that a gondola would effectively serve the function of the tram year-round, we feel that the tram is part of the identity and iconic attraction of Cannon.