APPENDIX C

REVIEW OF OPERATIONS PLAN
PREPARED BY WILBUR SMITH ASSOCIATES

DesertXpress Operations Plan Review
Prepared by: Wilbur Smith Associates
April 21, 2008

This review and assessment is based on the Regina EMU System Operations Plan as prepared by Bombardier Inc. The identity number provided on the basic document is S806-SWD-BRA-010001, dated November 28, 2007. In response to questions, DXE subsequently provided additional data regarding running times and ridership forecasts by day and direction. Since the Operations plan was prepared in November, 2007 and the detailed planning for the system has continued, some details of the operating plan may no longer be valid, but it continues to provide a general statement of how service is to be provided.

Summary of Operations Plan

The Operations Plan is primarily directed to a general description of normal operations, including failure management plans (contingencies) for service interruptions or failures. General information is provided on proposed schedules, fleet size, capacity, anticipated mileage, and other operating data.

The Operations Plan does not itself provide specific data related to projected passenger volumes, or how such volumes related directly to the analysis of station operations, parking and access adequacy. A separate report prepared by Cambridge Systematics, Inc. (CSI) for the FRA critically reviewed the project applicant's ridership study. The CSI study presented final ridership projections that will be utilized in the EIS. The CSI study was reviewed alongside the Operations Plan.

The system is described as generally following the I-15 highway alignment, with terminal stations at Victorville and Las Vegas. The operations, maintenance, and service facility (OMSF) would be located at Victorville. A proposed intermediate station at Barstow is mentioned in the Operations Plan but has been withdrawn from the EIS project description. There are no site plans for stations or the maintenance facility included in the Operations Plan, but such schematic plans were provided under separate cover to WSA and were reviewed with the Operations Plan.

The system comprises a double track main line between Victorville and Las Vegas, signaled for operation in either direction on either track, with crossover tracks located 10 to 25 miles apart along the route (see track plan, Figure 2-2). The Maximum tangent speed is 125 mph, and turnout (crossover) speeds are 50 mph. The system is proposed to operate every day, from approximately 6:00 AM to Midnight.

The Victorville station will have two station platforms serving two tracks.. Outside platforms are understood to be for passenger loading; a center platform would provide baggage access to both tracks.

Locations of station features, including parking, ingress/egress, and platforms are shown schematically on site plans that were provided to WSA under separate cover from the Operations Plan.

Checked baggage service is proposed, utilizing roll-on luggage bins stored in secure baggage areas at the end of each platform, and on-train baggage compartments in the end car of each train set. Baggage would be checked through from Victorville to each passenger's hotel, and for the return trip, directly from hotels to Victorville. Baggage service would be contracted to a baggage service contractor. The schematic drawing of station designs shows a center "baggage" service platform between the two tracks, with passenger platforms on the outside of each track. This suggests that baggage could be worked from one side of the train while passengers alight and board on the opposite side from the passenger platforms.

DXE is considering two propulsive technologies: Bombardier's Regina Electric Multiple Unit (EMU) and Bombardier's Meridian Diesel-Electric Multiple Unit (DEMU). The EMU is powered by overhead catenary. Each train would consist of 10 cars with a passenger capacity of 675 in a combination of first class and second class seating.

For the DEMU option, trains would consist of 10 cars with a passenger capacity of 478 in a first and second class combination.

The EMU option requires a minimum travel time from Victorville to Las Vegas (under ideal conditions) of 98.1 minutes. The return trip requires 94.4 minutes[1]. For normal operations, which include allowance for variations in equipment performance, possible delays in station boarding or alighting, and differences in operator handling, a typical one way trip would require 100 to 110 minutes including layover time. The layover dwell time at Victorville and Las Vegas, including time for necessary interior cleaning between runs, results in a planned operating cycle of 4 hours for each round trip.

The DEMU option would have similar top operating speeds, but with reduced acceleration and deceleration performance, requiring greater running times. The eastbound trip to Las Vegas would require 109.1 minutes and the westbound return would take 104.9 minutes. A one way trip could require 110 to 120 minutes including layover time.

Trains would operate at a maximum speed of 125 miles per hour, but actual speeds would be less through some curves and when operating on the steepest grades. The maximum grade (eastbound and westbound) is 4.50 percent.

A brief comparison of the reported characteristics of the two equipment options is shown below. These performance criteria may change slightly with updates to the forecasts or operating plans.

[1] Running times provided in EMU/DEMU comparison table as revised 4/1/08.

Characteristic	Regina EMU	Meridian DEMU
Passenger Cars per Train	10	10
Train Capacity (Seated)	675	478
Minimum Station Layover Time	20 minutes	20 minutes
Minimum Travel Time	100 minutes	115 minutes
Sunday Westbound Capacity	2012: 19,520 passengers 2041: 36,769 passengers	2012: 19,520 passengers 2041: 37,208 passengers
Round Trips per Week	2012: 155 2041: 298	2012: 220 2041: 415
Total Train Sets Required	2012: 16 2041: 25	2012: 21 2041: 39

Schedules are intended to provide the minimum number of daily trips specified in the URS Ridership Report (Draft Final Report, December 22, 2005, as modified by Transmax in April 2006). The ridership numbers are not repeated in the Operations Plan, but are noted and refined with the CSI ridership review study. The Operations Plan notes that scheduling details and plans for holiday or special event travel will be optimized (modified) after the alignment and operating parameters have been finalized.

Initial EMU service would require 16 equipment sets. Ridership in 2027 would require 20 sets, and ridership by 2041 would require 25 sets.

DEMU service, with lower capacity in each train, would require 21 initial sets and 39 sets by 2041. All calculations assume two spare train sets and two standby train sets (to be put into service in event of any disruption or mechanical problem with an in-service train). The operation plan is based on a 92% load factor during peaks and an 85% load factor at other times.

Proposed 2010 EMU schedules show 17 trips in each direction on a typical weekday, with headways (interval between trains) of 30 minutes to 1 hour. Two train sets would start from Las Vegas after an overnight layover, and two train sets would start from Victorville. Two additional train sets would be cycled into operation during the afternoon, enabling the 30 minute frequencies and allowing rotation of the equipment to the OMSF for servicing.

Proposed schedules are shown only for the EMU option, and are generalized as Monday-Thursday schedules, and Friday-Sunday schedules. However, a review of the operating characteristics above reveal that in both 2012 and 2041 DEMUs would make many more round trips per week than EMUs. Accordingly, this analysis concludes that the schedules for the two equipment types would be different.

Weekend (Friday-Sunday) service in 2010 would provide 33 trips in each direction with headways of 20 minutes during mid-day peaks and 30 minutes during morning and evening periods. Two train sets would lay over in Las Vegas and begin service there in the morning, while 10 additional sets would be phased into service from Victorville.

Some sets would make fewer trips than others, again allowing for rotation of the equipment into the OMSF for servicing.

Finally, the operating plan describes plans for failure management and service recovery following potential service disruptions. It also includes projections of operating and maintenance employee levels anticipated for the system.

Ridership Forecasts

Initial ridership forecasts for the DesertXpress system were prepared for the project applicant by URS Corporation in late 2005. FRA commissioned a peer review of the ridership study, which was finalized by Cambridge Systematics, Inc., in February, 2008. CSI reviewed the methodology and base data used for the original forecasts, and recommended modified forecasts as shown in the table below.

This analysis of the operating plan utilizes the CSI modified forecasts. As a result, some elements of the original operating plan that were designed for the earlier (higher) forecasts may need to be adjusted.

	URS Original Forecast	**CSI Modified Forecast**
DEMU Annual Round? Trips		
2012	2,186,427	1,947,478
2014	3,941,399	3,510,654
2035	6,466,311	5,759,623
EMU Annual Round Trips		
2012	2,775,915	2,472,305
2014	5,004,050	4,456,742
2035	8,209,709	7,311,789
Note: 2012 trips reflects a "ramp-up period" in 2012 and 2013, with the full forecast being attained by 2014.		

All the forecasts appear to be made in terms of round trips, with all trips originating at the Southern California end of the route.

In a subsequent phone discussion, DXE confirmed that a separate forecast for trips originating in Las Vegas is underway, but unavailable at this time. Additionally, while there is some discussion of surveys that show more travel volumes on particular days in the ridership forecasts, there is no clear definition of travel volumes by direction or by day in the URS or CSI forecasts. DXE subsequently provided data relative to volumes by direction, day, and time of day.

Using the CSI modified forecasts, annual travel (stated in round trips) was translated to average weekly volumes, and then doubled to provide a forecast of total one-way trips.

	DEMU	**EMU**
2014 Annual Round Trips	3,510,654	4,456,742

2035 Annual Round Trips	5,759,623	7,311,789
2014 Average Week Round Trips	67,327	85,471
2035 Average Week Round Trips	110,458	140,226
2014 Average Week 1-Way Trips	134,654	170,942
2035 Average Week 1-Way Trips	220,916	280,452

DXE provided supplemental forecasts of the share of trips that would be made by day and direction. These percentages (derived from surveys of current highway traffic volumes) resulted in the following forecasts.

	DEMU				**EMU**			
	North		**South**		**North**		**South**	
Year	2014	2035	2014	2035	2014	2035	2014	2035
Monday	4,915	8,063	12,254	20,103	6,239	10,236	15,556	25,521
Tuesday	6,329	10,383	5,790	9,499	8,034	13,181	7,351	12,059
Wednesday	6,531	10,714	7,137	11,709	8,291	13,602	9,060	14,864
Thursday	11,446	18,778	7,204	11,819	14,530	23,838	9,145	15,004
Friday	14,610	23,969	10,032	16,458	18,547	30,429	12,735	20,894
Saturday	12,321	20,214	8,483	13,918	15,641	25,661	10,769	17,668
Sunday	11,176	18,336	16,428	26,952	14,188	23,278	20,855	34,215
Total Week	67,327	110,458	67,327	110,458	85,471	140,226	85,471	140,226

DXE also provided forecasts of travel demand by time of day, again based on current highway volumes based on Kunzman traffic counts. For the southbound direction, these showed about half the travel occurring between Noon and 7PM, with peak demand slightly earlier on Saturdays and slightly later on Fridays. Northbound patterns are assumed to be similar. Typical hotel check-out times before Noon and check-in times after 3PM reinforce the expectation of the greatest travel demand during the mid-day hours, whether involving an auto trip of several hours or a DXE trip of less than two hours.

The highest volumes expected on Sundays for both the DEMU and EMU options become the critical levels in determining the ability of the system to accommodate projected travel. Using the Friday and Sunday distributions of highway traffic as a measure of expected DXE volumes by hour during each day, the highest volumes that stations and trains will need to handle are shown below. Peak passenger volumes for each day and direction are shown in boldface for both 2014 and 2035 years.

For Year 2014:

	Friday				Sunday			
	DEMU		EMU		DEMU		EMU	
	North	South	North	South	North	South	North	South
6 AM	190	130	241	166	89	131	114	167
7 AM	248	171	315	216	134	197	170	250

8 AM	336	231	427	293	246	361	312	459
9 AM	453	311	575	395	391	575	497	730
10 AM	570	391	723	497	548	805	695	1,022
11 AM	614	421	779	535	715	1,051	908	1,335
12 N	760	522	964	662	805	1,183	1,022	1,502
1 PM	891	612	1,131	777	905	1,331	1,149	1,689
2 PM	993	682	1,261	866	**950**	**1,396**	**1,206**	**1,773**
3 PM	**1,081**	**742**	**1,372**	**942**	928	1,364	1,178	1,731
4 PM	1,052	722	1,335	917	805	1,183	1,022	1,502
5 PM	993	682	1,261	866	782	1,150	993	1,460
6 PM	979	672	1,243	853	805	1,183	1,022	1,502
7 PM	906	622	1,150	790	749	1,101	951	1,397
8 PM	862	592	1,094	751	615	904	780	1,147
9 PM	833	572	1,057	726	536	789	681	1,001
10 PM	964	662	1,224	841	469	690	596	876
11 PM	964	662	1,224	841	369	542	468	688
12 M	950	652	1,206	828	291	427	369	542
Total	14,610	10,032	18,547	12,735	11,176	16,428	14,188	20,855

For year 2035:

	Friday				Sunday			
	DEMU		EMU		DEMU		EMU	
	North	South	North	South	North	South	North	South
6 AM	312	214	396	272	147	216	186	274
7 AM	407	280	517	355	220	323	279	411
8 AM	551	379	700	481	403	593	512	753
9 AM	743	510	943	648	642	943	815	1,198
10 AM	935	642	1,187	815	898	1,321	1,141	1,677
11 AM	1,007	691	1,278	878	1,174	1,725	1,490	2,190
12 N	1,246	856	1,582	1,086	1,320	1,941	1,676	2,463
1 PM	1,462	1,004	1,856	1,275	1,485	2,183	1,886	2,771
2 PM	1,630	1,119	2,069	1,421	**1,559**	**2,291**	**1,979**	**2,908**
3 PM	**1,774**	**1,218**	**2,252**	**1,546**	1,522	2,237	1,932	2,840
4 PM	1,726	1,185	2,191	1,504	1,320	1,941	1,676	2,463
5 PM	1,630	1,119	2,069	1,421	1,284	1,887	1,629	2,395
6 PM	1,606	1,103	2,039	1,400	1,320	1,941	1,676	2,463
7 PM	1,486	1,020	1,887	1,295	1,229	1,806	1,560	2,292
8 PM	1,414	971	1,795	1,233	1,008	1,482	1,280	1,882
9 PM	1,366	938	1,734	1,191	880	1,294	1,117	1,642
10 PM	1,582	1,086	2,008	1,379	770	1,132	978	1,437
11 PM	1,582	1,086	2,008	1,379	605	889	768	1,129
12 M	1,558	1,070	1,978	1,358	477	701	605	890
Total	23,969	16,458	30,429	20,894	18,336	26,952	23,278	34,215

In year 2014, when start-up ridership has "ramped up" to full levels, maximum hourly passenger volumes are expected to be 1,396 under the DEMU option and 1,773 under the EMU option. Both peak hour volumes will occur on Sunday in the southbound direction. By 2035, system growth will increase these maximum hourly volumes to 2,291 with DEMU equipment or 2,908 with EMU equipment. Again, these peak hourly volumes occur on Sunday. Peak volumes on Fridays will be somewhat lower, and occur in the northbound direction as more travelers head to Las Vegas for the weekend.

Assessment of the Operating Plan

The operating proposals contained in the plan appear reasonable, and consistent with expectations at this stage of the planning process for a major new transportation service. The equipment proposed for use is in service in Europe, and thus does not represent a questionable process of reinventing the wheel. The schedules presented, including running times and turn-around times at terminals, should be attainable. The proposal to have a "hot" trainset available at each end of the line is particularly important since it would be key to many types of delays or disruptions that can occur. The operating plan does not appear to promise more than the system as described should be able to deliver.

WSA conducted a limited Web search for specific reports of Regina EMU operations in Sweden and Meridian DEMU operations in the United Kingdom. WSA was unable to find enough material on the Web to allow it to comment on the service reliability of these units. Their manufacturer, Bombardier, would need to provide evidence of their reliability to WSA before WSA can comment further.

WSA did note that Sweden's SJ Railway announced the purchase of 20 Regina trains for intercity service in early 2008. The Meridian trains, British Rail Class 222, have been in service since 2004, and are operated by East Midland Trains and Hull Trains.

The railroad infrastructure as described should be capable of handling the number of train movements described. WSA assumes that the simulations done by Bombardier to date have confirmed that the crossover spacing is sufficient to accommodate train movements on a single track in the event of a disabled train or other disruption that might close one track. Since WSA does not know what software was used and has not seen detailed results, we can only make an assumption that the system can adequately respond to service disruptions.

The EMU operating plan is based on trains with 675 seats, running at 85% to 92% load factors. Applying these load factors to the proposed 20 minute headways (3 trains per hour) would result in approximately 1,720 to 1,865 passengers.

The DEMU option proposes trains with only 478 seats. The stated load factors would accommodate 1,220 to 1,320 passengers.

For the EMU option, the maximum hourly count would occur southbound on Sundays with 1,773 riders in 2014 and 2,908 in 2035. Thus, the 20 minute headways would

accommodate the projected maximum hourly volume in 2014 but would fall short in 2035.

The DEMU option would present a maximum hourly count of some 1396 to 2291 in the two forecast years. Thus, the DEMU service with 20 minute headways would not meet anticipated peak hour demand.

However, both equipment types would easily satisfy demand during all but the two or three peak hours on Sunday. The operating plan does not specify pricing strategies or reservation requirements. However, it is assumed that DXE would adjust pricing to charge more during these peak periods in order to both generate maximum revenue and to limit ticket sales to available capacity during peak hours on Friday and Sunday afternoons.

DEMU equipment will require refueling. Since DXE will only be utilizing all available train sets during the peak afternoon periods, it will have ample opportunity to cycle the trainsets into service on a schedule that allows all refueling to take place at the maintenance facility in Victorville. No refueling should be necessary at the terminal stations.

Our primary concern is that there is no specific assessment in the operating plan to demonstrate the ability of the stations to handle the anticipated passenger volumes. This concern relates to vehicular access, parking, and station passenger amenities. The system is proposed as a self-supporting commercial venture, and as such we must assume that the owners/operators would make every effort to ensure that these concerns are met with minimal impact on local communities and in a manner that makes the total trip (access from the home end, the station experience, the train trip, and the transfer to accommodations in Las Vegas) convenient for the passengers. More attention to these concerns is needed than has been shown in the operating plan since they are an integral part of the total trip.

On weekends, and particularly Sunday when the greatest number of passengers would be returning from Las Vegas to the Los Angeles basin, train headway is proposed to be as short as every 20 minutes, with only 20 minutes allowed between arrival and departure times of each equipment set. During this brief 20 minutes, the following events must occur:

- Potentially 675 passengers[2] need to exit the arriving train, some carrying luggage.
- Containerized checked baggage must be removed from the train and either delivered to hotels or claimed by passengers.
- A service crew must board the train and undertake a quick trash collection, light cleaning, and check for readiness for the next departure.

[2] 675 is the capacity of each train. At peak travel times, occupancy over 90% is anticipated. Travel volumes in the opposite direction will be somewhat lower because peak travel in each direction will occur on different days.

- Any food or beverage items planned to be available for passengers must be loaded or restocked.
- Checked baggage needs to be received from arriving passengers or hotels, placed in containers, and loaded onboard the train.
- Up to 675 passengers need to board the waiting train, some carrying luggage.

WSA is concerned that this level of activity may be too much to accomplish within the brief 20 minute layover planned for most train sets. A more detailed analysis of passenger, luggage, and service movements needs to be done to demonstrate the ability of the system (including station design) to accommodate this level of activity over the 3 to 5 peak hours when 20 minute headways[3] are planned.

The Operations Plan includes anticipated employment by function and number. We assume that the sponsors have estimated needed employee levels as closely as possible, and would make any appropriate adjustments when service begins to maintain a competitive level of service.

[3] It should be noted that the two-track stations could accommodate 20 minute headways with station dwell times of 35 to 40 minutes, should the 20 minute goal be difficult to maintain. One train would arrive on one track, while the second train would arrive on the second track 20 minutes later. Each train would leave 40 minutes after arrival, and would be immediately replaced by another incoming train set. This pattern of operation would require additional train sets and a high level of operating precision.