



## MEMORANDUM: INITIAL CONCEPTS SUMMARY

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### INTRODUCTION

This memo presents a summary of initial concepts that have been identified as development of the project study has progressed, along with a recommendations and approximate costs for implementation of these concepts.

The I-15 and Tropicana Interchange Study has progressed well into the alternatives analysis phase. During identification of potential project alternatives, several concepts emerged that could improve specific aspects of the existing interchange or other aspects of vehicle and pedestrian movement that do not necessarily fit in the “ultimate improvement” group of concepts. These concepts have been screened out of the potential preferred alternative(s) selection, but still offer positive benefit and should be considered by the Department for interim or immediate implementation.

### ALTERNATIVE CONCEPT IDENTIFICATION

The Study Project brought together representatives from NDOT, the Southern Nevada RTC, Clark County and the Project Consultant Team’s staff to brainstorm possible solutions to the operations issues of I-15 and Tropicana Avenue at the I-15 and Tropicana Interchange. A design Charrette was held to bring all of the participant’s ideas together and review them for consideration. Concepts developed in previous studies were also considered and discussed. A large number of concepts were identified during the project concepts development charrette, with over 50 concepts making it past the initial discussions to the screening process of the project study report. Concepts were assigned individual values based on their level of conformance to accepted concept screening criteria. Concept evaluation is still under way, however, certain concepts do not grade well with respect to specific desired criteria, or are not compatible with other ultimate project features. In addition to the concepts identified during the design charrette, NDOT’s internal staff also requested that additional concepts related to restriping of I-15 be evaluated. These concepts are presented in this memo for further consideration by NDOT.

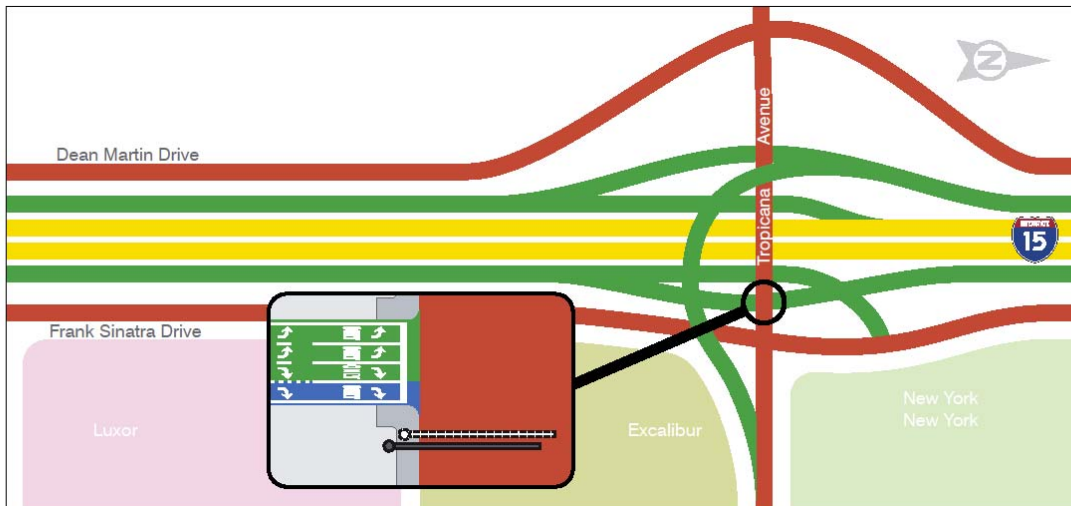






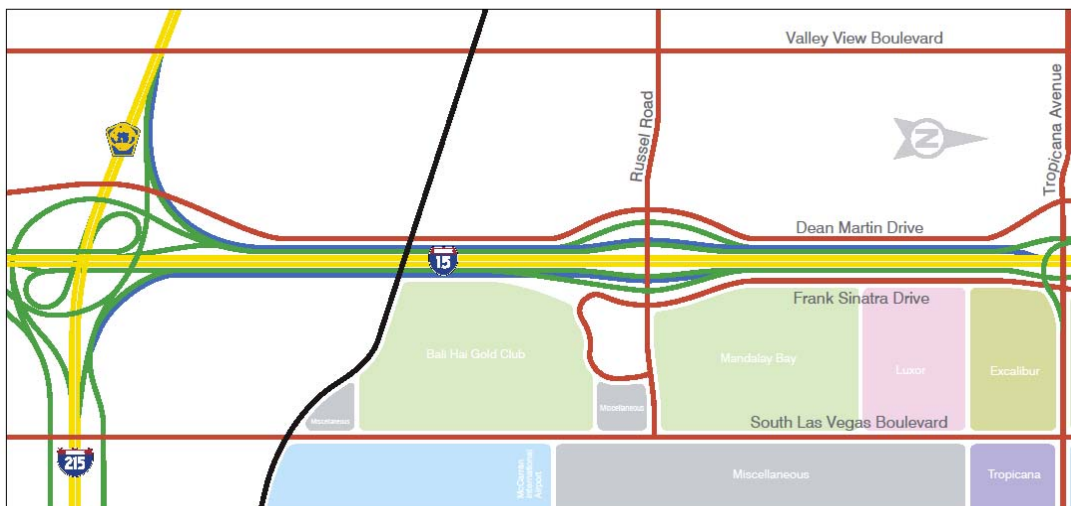
### 5) Signal Pole Relocation

Relocate the existing south-side signal pole at the east intersection of the interchange such that it no longer encroaches on the existing sidewalk. The existing sidewalk is pinched by the current location of the signal pole such that it is not ADA compliant, and does not meet sidewalk standards. The intent of relocating the pole is to open the sidewalk up to improve pedestrian access. This concept is identified as Concept 15 in the overall study report.



### 6) Three Lane CD Roads

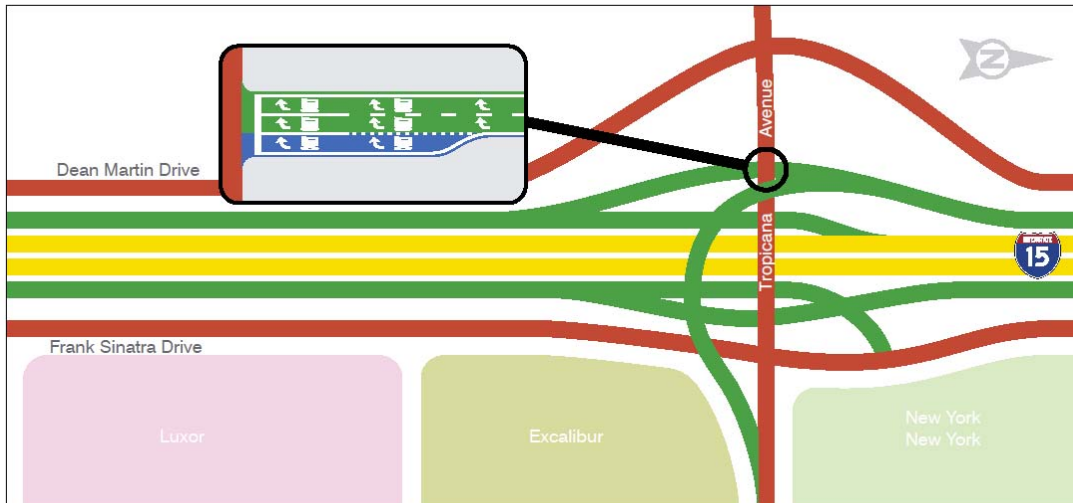
Stripe the CD roads to three lanes where they aren't already three lanes today between I-215 and Russell. This concept is identified as Concept 8 in the overall study report.





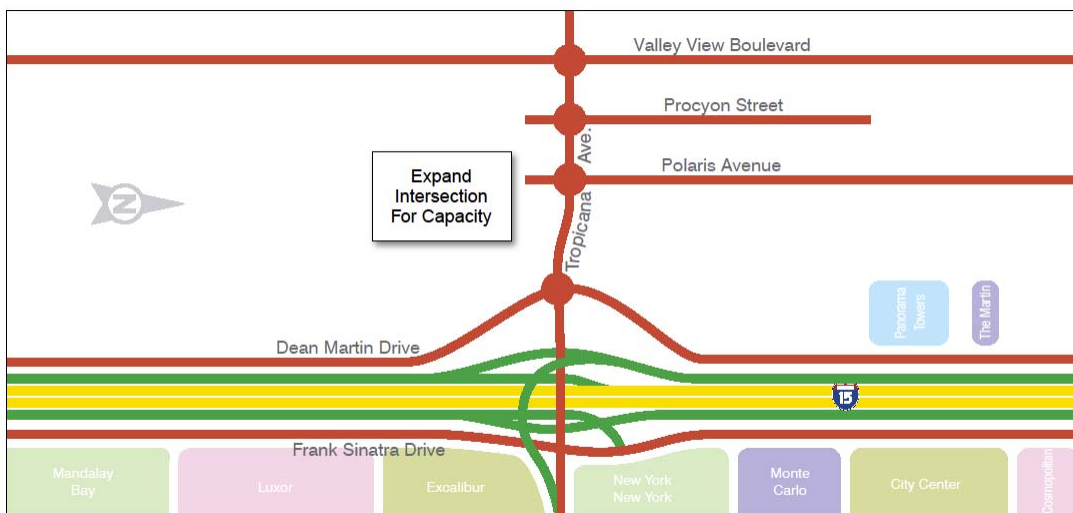
### 7) Tropicana/I-15 West Intersection Add Lane SB

Restripe the existing area in the southbound exit ramp to accommodate three right turn lanes. This concept is identified as Concept 18 in the overall study report.



### 8) Tropicana Intersections

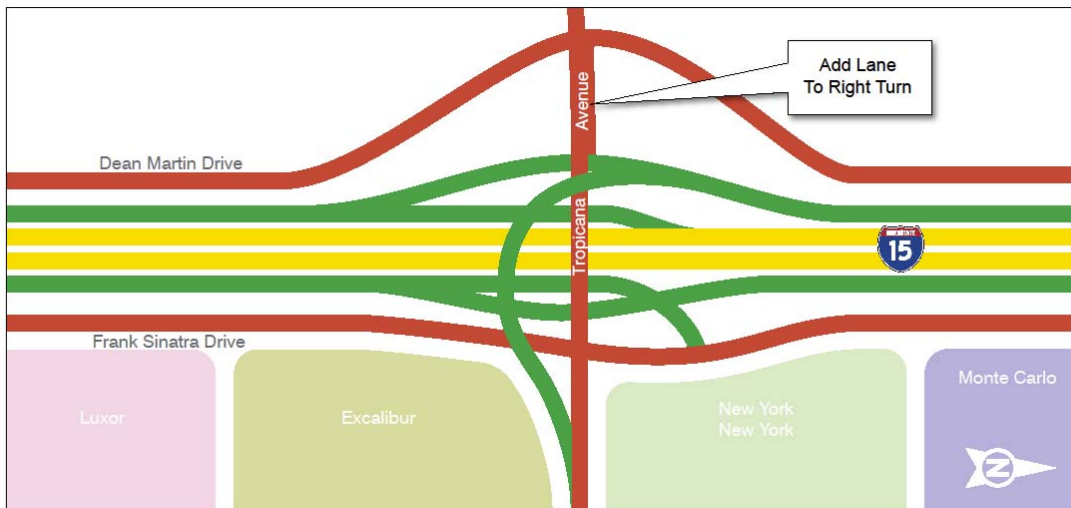
Strengthen the intersections along Tropicana Avenue with Valley View, Polaris, Procyon and Dean Martin by providing additional right turn, left turn and through lanes in all directions. The intent is to improve the operation of the intersections and throughput along Tropicana Avenue. This concept is identified as Concept 44 in the overall study report.





### 9) Westbound Right Turn at Dean Martin

Add a right turn lane westbound at Dean Martin. This concept adds a lane north of the existing Tropicana Avenue between the I-15/Tropicana southbound exit ramp terminal and Dean Martin Drive. The intent is to improve the operations and capacity of both intersections. This concept is identified as Concept 43 in the overall study report.



### 10) Reconfigure I-15 Lanes

Restriping I-15 to 11-foot wide lanes will increase the number of lanes that can fit under the existing Tropicana bridge structure. The intent is to alleviate the existing north bound CD ramp entrance to I-15 and reduce the delay caused by the existing tapered entrance. More than one striping alternative could be realized, with 3 alternatives being considered for the possible solution.

- Stripe to 11-foot lanes, extending the CD ramp lane parallel to I-15 north of its current merge location and drop then merge the CD road entrance ramp lane prior to the Tropicana to northbound I-15 entrance ramp gore.
- Drop one of the existing northbound express lanes in order to shift the mainline northbound I-15 GP lanes west to allow the CD road to have its own lane going northbound. This lane would continue as an auxiliary lane all the way to Spring Mountain, where it would drop into the northbound exit ramp.

### CONCEPT DETAILS AND EVALUATION

Cost benefit is an important element when determining whether or not design concepts should be recommended for further action. For the purposes of preparing this memo, specific concepts were evaluated using cost benefit while others were not.

Concepts precluded by adjacent projects or dependence upon other agency's funding or action were not analyzed using cost benefit methods. Concepts that were identified either outside of the original project scoping limits, or those where existing traffic counts or other traffic data were not readily available were evaluated more subjectively, using engineering judgment to determine reasonableness. Concepts based solely on accessibility were also evaluated in this manner.

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**1) and 2)** are either – or concepts. If it is desirable to construct one, the other will be precluded. Both concepts attempt to clear up weaving on the CD roads between Russell road and the Tropicana and Frank Sinatra exit ramp. It is clear that removing the Russell road to I-15 traffic from the CD road will reduce the volumes of traffic that weave on the CD and the volumes that enter I-15 at the CD road terminus. Field review of the existing traffic situation observes operational breakdown in the weave section at the CD entrance to I-15 just south of the Tropicana bridge.

The Ramp Braiding concept will not require modification to the I-15 and Tropicana Bridge, as the entrance ramp would remove traffic from the CD that causes the breakdown at the CD entrance and merge it with I-15 earlier, better distributing the traffic and lengthening the weaving section for those volumes.

The CD modification concept will maintain the existing conditions, but will better separate and pre-position traffic in the CD lanes, substantially reducing the weave between the Tropicana/Frank Sinatra exiting traffic and the Russell Road to I-15 entrance traffic. The only traffic needing to weave would be the eastbound I-215 to northbound I-15 traffic. This traffic could be braided with the Tropicana/Russell exit slip ramp and removed from the CD at that point. In either case, the volumes entering I-15 at the north end of the CD road would still likely experience the operational issues that exist today, which would then require an additional CD lane entering I-15 and widening of the I-15/Tropicana Bridge.

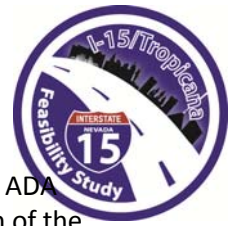
**3)**, the southbound CD choice lane concept was presented as a solution to enhance the operations of the Tropicana Interchange to I-15 southbound entrance ramp. The entrance ramp to I-15 consists of a relatively long stretch of travel on the southbound CD system, and is combined with the I-15 and I-215 interchange's system movements. The concept presents several opportunities with respect to observed operational deficiencies and potential operational enhancements at the I-15/I-215 split, however, the study team debated whether or not the choice lane can be implemented within the limits of the study. This has been discussed with NDOT Roadway, traffic and Project Management. Even though the specific improvements shown in the CD Choice Lane concept are meritorious, the operational issue at the split is compounded by further operational issues on westbound I-215. Traffic analysis performed during the I-15 South Design Build project determined that without correction to the I-215 deficiencies, the system to system movement performance would be degraded.

**4)** As a stand-alone project, the project seems to offer many benefits including increasing the storage capacity of the northbound off ramp by 33%. This proposed improvement was modeled using Synchro and resulted in an improvement of the overall intersection delay from 57 to 39 seconds per vehicle in the AM peak hour and from 116 to 111 seconds per vehicle in the PM peak hour. This represents an overall delay saving of approximately 30 hours each day. This translates to a benefit cost ratio of 3.25 when considering the time value saved in just five years.

Widening the existing ramp to the east would require retaining walls to be constructed at the east edge of pavement or further down the slope. This concept as a project would be an interim improvement to the ultimate interchange configuration and will be replaced at the time the new interchange is constructed.

**5)** would also be an interim improvement that would be replaced when the new interchange is constructed, but it offers many safety improvements. Pedestrians would have a full, unobstructed sidewalk path across I-15. Especially considering that there is no existing sidewalk on the north side of Tropicana between the New York New York and the west interchange signal, it is imperative that the

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existing access be as accommodating as possible. The current sidewalk width at the pole is not ADA compliant, and could be a hazard to pedestrians in wheelchairs or motorized chairs. Relocation of the existing pole would be required in combination with the northbound intersection leg widening, but should be considered if that concept is not implemented.

**6)** would require milling and overlay of the existing CD roads that were finished less than three years ago, however, the added capacity could improve operations and increase volumes on the CD roads. The CD roads are bounded by barrier rail on both sides, with 6 and 8 foot shoulders inside and out respectively. Restriping to three lanes would require reduction of the shoulders to 2-feet on each side. While the additional lane would add capacity in optimal conditions, NHP enforcement, an accident or vehicular break down in any lane could cripple the three lane CD system as there would be no enforcement or recovery area for the accident or break down to move to. Even the two-lane CD system has its issues with break downs causing significant delays. The existing CD system has locations where three lanes were constructed to enable traffic to better position for upcoming destination merges or entrances/exits with full shoulders. Previous discussions with NDOT Roadway and Project Management regarding restriping to three lanes have been met with skepticism as to the perceived benefits.

Adding the third lane on the NB CD between I-215 and Russell Road does not provide a measurable change in the free flow speed on the CDs due to the relatively low volumes, this makes it difficult to quantify any improvement in delay.

**7)** is similar to the northbound exit ramp widening, with the added benefit of there already being existing pavement in place. A minor mill and restripe effort would be necessary to restripe the available pavement to three lanes for right turns. This would allow vehicles desiring to make a left turn onto Dean Martin Drive to pre-position away from westbound Tropicana avenue drivers which should improve that movement as well. Minor restriping on Tropicana might be needed to channelize the center right turn lane, but it could be accomplished with minimal cost.

This proposed improvement was modeled using Synchro and resulted in an improvement of the overall intersection delay from 38 to 28 seconds per vehicle in the AM peak hour and from 33 to 31 seconds per vehicle in the PM peak hour. This represents an overall delay saving of approximately 15 hours each day. This translates to a benefit cost ratio of 9.3 when considering the time value saved in just five years.

**8)** Widening all of the intersections west of I-15 would be a significant project as the existing intersections occupy the entirety of the current right-of-way. Clark County has widening of Tropicana to four lanes in each direction in the 2035 TIP, however it is unclear when that will actually come to fruition. Widening the intersections as an interim project has the potential to improve the capacity and operations of traffic on Tropicana west of the I-15 interchange, but without widening of the existing bridge to accommodate 4 through lanes, it would not realize the desired intent.

**9)** proposes to open a 4<sup>th</sup> lane between the southbound I-15 to Tropicana interchange exit ramp as a trap lane at Dean Martin. This could improve access for I-15 exiting drivers desiring to turn north onto Dean Martin. It would also provide a right turn pocket area for westbound Tropicana drivers. It would need to be striped and marked as right turn only, with additional striping on the ramp to channelize right turn to through movements correctly. Providing this lane would improve operations of the Tropicana and Dean Martin signal in that right turners would have the opportunity to leave the through lanes prior to slowing fully for their turn. The Synchro model of this improvement did show a significant improvement to the intersection delay and the addition of an exclusive right turn lane has a Crash Reduction Factor of 14.



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**10)** will require additional input from NDOT as to the preferred lane configuration, as well as acceptance from FHWA in order to reduce lane and shoulder widths on I-15. In order to restripe I-15 in the north bound direction, milling of the full width pavement is recommended so that ghost striping effects are eliminated. This concept proposes to solve to some degree the existing conflict of traffic at the CD road entrance to I-15 at the merge point by extending the ramp merge to a parallel entrance that will allow better gap acceptance and merge operations. It should relieve back-up of traffic from the CD road entrance merge to I-15 northbound. Existing lane balance issues will still be present between Tropicana entrance and Flamingo/Spring Mountain exit ramps.

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**ANTICIPATED COSTS OF CONCEPTS**

NDOT Wizard spreadsheet cost estimates were prepared for the initial concepts at a high level to determine probable construction costs and for cost/benefit evaluations. NDOT Wizard estimates are approximate only, offering a rough order of magnitude that is useful for planning and conceptual evaluation. Estimated costs, in 2014 dollars, are provided for each of the concepts and presented in the following table:

*TABLE OF COSTS*

<b>Initial Concept</b>	<b>I-15/Tropicana Concept</b>	<b>NDOT Wizard Low Range Estimate</b>	<b>NDOT Wizard Low Range Estimate</b>
1)	2	\$20,800,000	\$26,200,000
2)	3	\$5,600,000	\$6,900,000
3)	9	\$2,800,000	\$3,400,000
4)	16	\$200,000	\$200,000
5)	15	\$100,000	\$100,000
6)	8	\$900,000	\$1,100,000
7)	18	\$34,500	\$34,500
8)	44	\$2,200,000	\$2,200,000
9)	43	\$300,000	\$300,000
10)	NA	\$1,704,000	\$2,050,000

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**RECOMMENDATIONS**

TABLE OF RECOMMENDATIONS

Initial Concept	I-15/Tropicana Concept	Recommended Action
1)	2	It is recommended that NDOT further review Initial Concepts 1 and 2 for potential implementation as part of continued efforts to improve operations on I-15 and the CD road.
2)	3	It is recommended that NDOT further review Initial Concepts 1 and 2 for potential implementation as part of continued efforts to improve operations on I-15 and the CD road.
3)	9	Based upon study from the I-15 South Design build project, traffic analysis had determined that there could be an improvement from providing additional lanes to west-bound CC-215, depending upon operations of CC-215. It is recommended that no action be taken at this time, but that NDOT continue to monitor the performance of the CD road at the 215 split, and work with Clark County to identify funding for the future project to improve operations on the SB CD at Tropicana’s SB I-15 entrance.
4)	16	This project would construct a ramp widening that would be rebuilt when the ultimate interchange improvements are implemented, however it could be constructed with minor earthwork and pavement, and could benefit the intersection operations in the interim. It is recommended that this concept be considered for implementation.
5)	15	As this concept would improve accessibility for pedestrians and considering that there is no sidewalk on the north side of Tropicana, it is recommended that this concept be considered for implementation.
6)	8	Even though an increase in capacity was expected given the adding of a lane on the cd roads, lane balance issues and 2-foot shoulders would create bottlenecks that negate the positive effects. NDOT may desire to review this concept at a later date in combination with minor widening of the CD roads, but this concept is not recommended currently.
7)	18	The costs of implementing this concept are relatively low. The improvements do not offer substantial measurable increases in operational performance or capacity, however with a benefit cost ratio of 9.3, it is recommended that this concept be considered for interim implementation.
8)	44	Clark County’s TIP includes widening of Tropicana in the future, and the costs of improving Tropicana would be substantial. As an interim project to be constructed by NDOT, it is not recommended to consider this concept for action.
9)	43	Working with concept 7, and including providing some updated signs, this concept would provide a dedicated lane for right turns onto Dean Martin, as well as provide space for SB exiting vehicles to access Dean Martin NB without queuing in the through lanes at the Dean martin signal. This implementation has a crash reduction factor of 14, and is recommended for further consideration by NDOT.
10)	NA	As an interim improvement, in order to alleviate congestion on the CD road and on I-15 where the entrance causes friction with the NB I-15 traffic, it is recommended that NDOT further consider this concept for implementation until the full I-15 width can be constructed.



### CLOSING AND STUDY SUMMARY

This report contains a full list of design charrette concepts that were screened as not appropriate for consideration as ultimate interchange improvements in the final configuration of the Tropicana and I-15 interchange. These improvements were conceptualized at the interchange study design charrette, and identified as potential solutions without full study or consideration of other impacts.

CA Group has performed a screening of these concepts and further evaluated the feasibility and compatibility of each with the current I-15 mainline configuration, planned improvements on Tropicana, existing deficiencies in traffic operations and potential benefits of implementation of these concepts.

CA Group recommends additional review of Initial Concepts 1 and 2 using CORSIM or other traffic analysis methods in order to evaluate the future performance of I-15 given the interchange's dependency on traffic from I-15 to serve the interchange demands.

CA Group's recommendations of initial concepts 4, 5, 7, and 9, represent a total initial project cost of \$634,000 and are presented for further action by NDOT.

CA Group recommends initial concept 10 be considered for implementation as part of its own or in combination with another project(s) to alleviate congestion on the NB CD road and on I-15 at the current CD merge location.

CA Group also recommends that NDOT reconsider Option 1 for study as an ultimate I-15 improvement as it has substantial potential benefits regarding weave reduction. It represents an initial project cost of \$20M to \$26M.

CA Group also recommends that NDOT reconsider Option 3 for study as a potential interim project, but through coordination with Clark County and their plans to improve CC-215 West Bound to Decatur. It is estimated that the improvements to the fork area and ramp represent an initial project cost of \$2.8M to \$3.4M.