Crash Cushions

Basics and a little more

September 24,2024

Table of contents

Crash Cushion Categories

- Low Maintenance- Generally the most expensive install costs, the least expensive repair costs and the least amount of time to repair.
- Reusable- Generally less expensive install cost than low maintenance. Crash cushions can be repaired from most impacts, but will cost more money and/or time to repair than crash cushions in the Low Maintenance category
- Sacrificial- This category of crash cushion will likely need to be replaced after each impact

Current Crash Cushions

Low Maintenance	Reusable	Sacrificial
QGELITE(M10)(N)	QGUARD(M10)(N)	SSCC
QGELITE(M10)(W)	QG(M)(W)	CATCB(1)
REACT(M)	TAU(M)(N)	MATT(1)
REACT(W)	TRACC(W)	ABSORB(M)
SMTC(N)	DELTACC	SLEDMINI
SMTC(W)		SLED
TAU-)II-R(N) ⬅ TAU-XR		VIA(SFPM)
TAU-II-R(W)		
…. = Not MASH Compliant		

1. The highlighted crash cushions should only be sole sourced. Non-MASH Crash cushions should not be competing with MASH Crash Cushions
2. Manufacturers may stop servicing the highlighted crash cushions at any time.

How to choose the correct category

When replacing a crash cushion check the crash history at the location.

As a guide

- Low Maintenance – when 2 or more impacts/yr
- Reusable – when between 1 and 2 impacts/yr are expected
- Sacrificial- When 1 or fewer impacts are expected/yr
- Other considerations- Safety of repair crew, repair time, geometry of roadway, cost difference between categories
  - When the risk to the repair crew will be increased or the geometry would cause a lane closure a higher category should be considered

What is the Crash Cushion Summary Sheet

- Crash Cushion Summary Sheet is a summary sheet that provides information for contractors and suppliers on what crash cushions to provide for a project.
- Crash Cushion Summary Sheet is required on all projects that include Crash Cushions.

What is the purpose of the CCSS

- The CCSS provides information to the contractor to clarify what crash cushions to bid to provide a more accurate bid.
- When filled out correctly, the CCSS will inform the supplier the correct transitions that need to be included
- The CCSS ensures that designers consider the crash cushion at each location specifically.

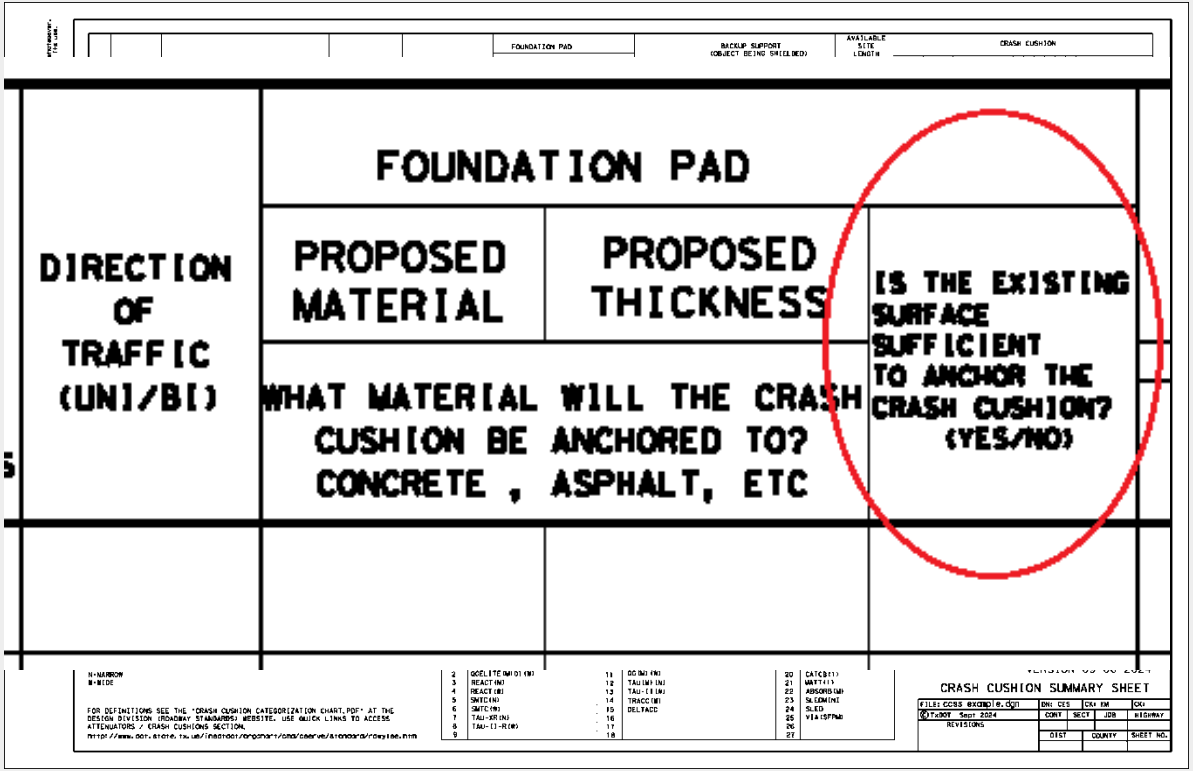
What problems does the CCSS solve?

- Reduces risk of conflicting plans
  - E.g. Currently plans often conflict. Bid codes will indicate one category of crash cushion while the standard sheets included in the plans a different category. When filled out correctly, CCSS will provide opportunity to tie plans together.
- CCSS ensures designers consider each location
  - Choosing the wrong category of crash cushion could have wide financial implications over the life of a crash cushion

- Ensures contractors and suppliers have the correct information to provide what is needed for each location

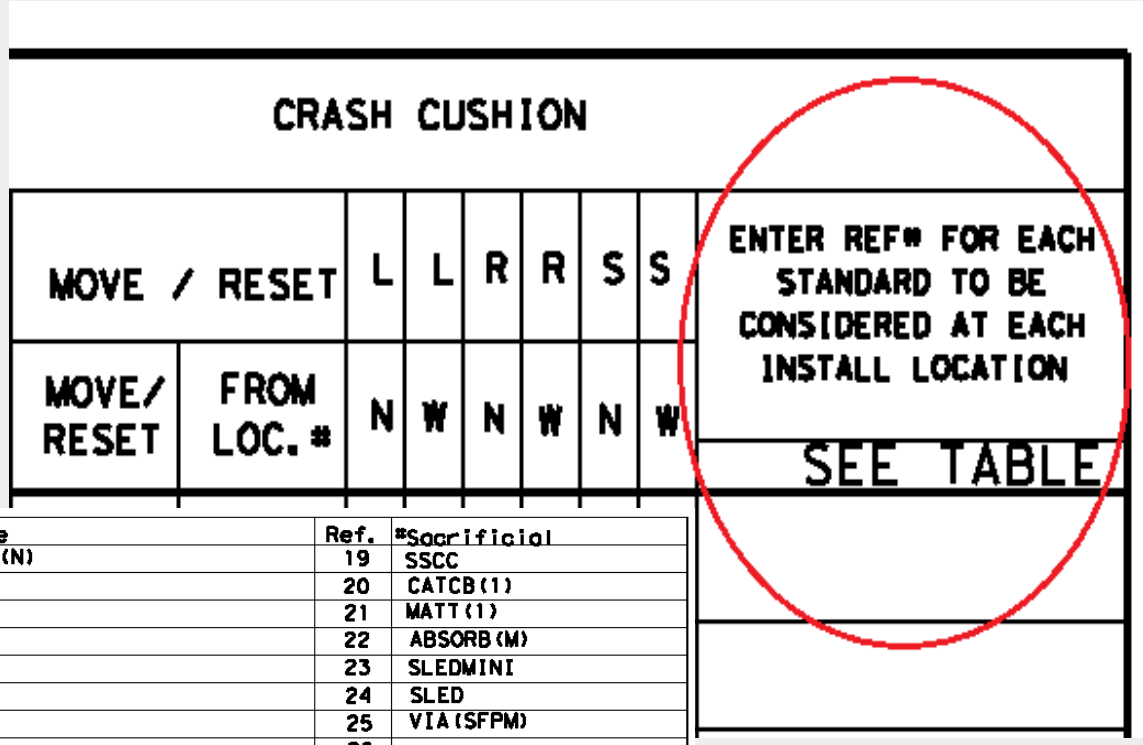
Crash Cushion Summary Sheet updates

- Is surface where crash cushion will be installed sufficient for a foundation pad?



Crash Cushion Summary Sheet updates

-Are all the standard sheets that are included in the plans relevant to each location?



CRASH CUSHION

MOVE / RESET		L	L	R	R	S	S
MOVE/ RESET	FROM LOC. #	N	W	N	W	N	W

ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION

SEE TABLE

Ref.	#Low Mainenance	Ref.	# Reusable	Ref.	#Sacrificial
1	QGELITE(M10)(N)	10	QGUARD(M10)(N)	19	SSCC
2	QGELITE(M10)(W)	11	QG(M)(W)	20	CATCB(1)
3	REACT(M)	12	TAU(M)(N)	21	MATT(1)
4	REACT(W)	13	TAU-II(W)	22	ABSORB(M)
5	SMTC(N)	14	TRACC(W)	23	SLEDMINI
6	SMTC(W)	15	DELTACC	24	SLED
7	TAU-XR(N)	16		25	VIA(SFPM)
8	TAU-II-R(W)	17		26	
9		18		27	

How to complete the CCSS

DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

LOC NO.	TCP PHASE	PLAN SHEET NUMBER (optional)	LOCATION DESCRIPTION OF LOCATION. (CROSS STREET, GORE, LEFT OR RIGHT, ETC)	STA APPROX. STATION NUMBER OF CC	TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD: PROPOSED MATERIAL (WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE, ASPHALT, ETC)	FOUNDATION PAD: PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	BACKUP SUPPORT (OBJECT BEING SHIELDED): DESCRIPTION (SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE)	WIDTH (WIDEST WIDTH OF OBJECT BEING SHIELDED)	HEIGHT (HEIGHT OF OBJECT BEING SHIELDED)	AVAILABLE SITE LENGTH (LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION)	CRASH CUSHION: INSTALL	REMOVE	MOVE / RESET: MOVE/ RESET	MOVE / RESET: FROM LOC.#	L N	L W	R N	R W	S N	S W	ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION SEE TABLE
1	Phase 1	121	IH 35 @ imaginary rd	456+32	TL3	Bi	Asph	2'	Yes	F-Shape	24'	32'	32'	X									X	22,24
2	Phase 2	125	Temp Exit ramp@Exit 127	457+42	TL3	Uni	Conc	8"	Yes	LPCB	28'	20"	25'	X									X	22
3	Perm	125	IH 35 @ Imaginary 2 rd	457-32	TL3	Bi	Conc	8'	Yes	T551	17'	32'	30'	X						X				10,12,15
4	Phase2	126	IH35@NW corner blank crk brg	458+18	TL3	Uni	Conc	8"	Yes	221	12'	32"	>50'		X								X	
5	Phase2	132	median barrier end	460+80	TL3	Bi	Conc	10"	Yes	Single Slope	24"	42'	23'			X	2						X	
6	Perm	133	IH 35 @ blah blah rd	466+84	TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50'	X				X						1,3,5
7	Phase2	133	Temp Exit ramp@Exit 127	457+42	TL3	Uni	Conc	Standard	Yes	Single Slope	24'	42"	>50'		X								X	
8	Perm	133	IH 35 @ blah blah rd	466+84	TL3	Uni	Conc	Standard	Yes	Single Slope x2	48'	42'	>50'	X					X					2,4,6
9	Perm	135	IH35 @100 gore underpass	476+80	TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"	X					X					4,6

LEGEND:
L=LOW MAINTENANCE
R=REUSABLE
S=SACRIFICIAL
N=NARROW
W=WIDE

1. If all standard sheets for selected category are not relevant an explanation is required under Item 545 in general notes.

FOR DEFINITIONS SEE THE "CRASH CUSHION CATEGORIZATION CHART.PDF" AT THE DESIGN DIVISION (ROADWAY STANDARDS) WEBSITE. USE QUICK LINKS TO ACCESS ATTENUATORS / CRASH CUSHIONS SECTION.
http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/rdwylse.htm

Ref. #	Low Maintenance	Ref. #	Reusable	Ref. #	Sacrificial
1	QGELITE (M10) (N)	10	QGUARD (M10) (N)	19	SSCC
2	QGELITE (M10) (W)	11	QG (M) (W)	20	CATCB (1)
3	REACT (N)	12	TAU (M) (N)	21	MATT (1)
4	REACT (W)	13	TAU-II (W)	22	ABSORB (M)
5	SMTC (N)	14	TRACC (W)	23	SLEDMINI
6	SMTC (W)	15	DELTACC	24	SLED
7	TAU-XR (N)	16		25	VIA (SFPM)
8	TAU-II-R (W)	17		26	
9		18		27	

VERSION 09-06-2024

CRASH CUSHION SUMMARY SHEET

FILE: ccss example.dgn | DN: CES | CK: KM | DW: | CK:
© TxDOT Sept 2024 | CONT | SECT | JOB | HIGHWAY
REVISIONS | DIST | COUNTY | SHEET NO.

Location Information

- Identifies each crash cushion location
- Ensures contractor knows each location
- Ensures each crash cushion is addressed in plans

LOC NO.	TCP PHASE	PLAN SHEET NUMBER (optional)	LOCATION DESCRIPTION OF LOCATION. (CROSS STREET, CORE, LEFT OR RIGHT, ETC)	STA APPROX. STATION NUMBER OF CC	TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS
1	Phase 1	121	IH 35 @ imaginary rd	456+32	TL3
2	Phase 2	125	Temp Exit ramp@Exit 127	457+42	TL3
3	Perm	125	IH 35 @ imaginary 2 rd	457+32	TL3
4	Phase2	126	IH35@NW corner blank crk brg	458+18	TL3
5	Phase2	132	median barrier end	460+80	TL3
6	Perm	133	IH 35 @ blah blah rd	466+84	TL3
7	Phase2	133	Temp Exit ramp@Exit 127	457+42	TL3
8	Perm	133	IH 35 @ blah blah rd	466+84	TL3
9	Perm	135	IH35 @100 acre underpass	476+80	TL3

Location Information (TCP Phase)

- This section is meant to help identify the location and how the crash cushion will be used.
- Traffic Control Plan (TCP) phase should be completed especially if the crash cushion is used in the work zone.
- It is acceptable to label it as “permanent” installation.

LOC NO.	TCP PHASE	PLAN SHEET NUMBER	LOCATION *Description of location. (cross street, gore, left or right, etc)*	STA *Approx. Station number of CC*	TEST LEVEL *TL2=<=45mph TL3=All speeds*
1	Phase 1	121	IH 35 @ imaginary rd	456 32	TL3
2	Phase 2	125	Temp Exit ramp@Exit 127	457+42	TL3
3	Perm	125	IH 35 @ imaginary 2 rd	457+32	TL3
4	Phase2	126	IH35@NW corner blank crk brg	458+18	TL3
5	Phase2	132	median barrier end	460+80	TL3
6	Perm	133	IH 35 @ blah blah rd	466+84	TL3
7	Phase2	133	Temp Ex't ramp@Exit 127	457+42	TL3
8	Perm	133	IH 35 @ blah blah rd	466+84	TL3
9	Perm	135	IH35 @100 acre underpass	476 80	TL3

Location Information (Location Description)

LOC NO.	TCP PHASE	PLAN SHEET NUMBER (optional)	LOCATION DESCRIPTION OF LOCATION. (CROSS STREET, GORE, LEFT OR RIGHT, ETC)	STA APPROX. STATION NUMBER OF CC	TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS
1	Phase 1	121	IH 35 @ imaginary rd	456+32	TL3
2	Phase 2	125	Temp Exit ramp@Exit 127	457+42	TL3
3	Perm	125	IH 35 @ imaginary 2 rd	457+32	TL3
4	Phase2	126	IH35@NW corner blank crk brg	458+18	TL3
5	Phase2	132	median barrier end	460+80	TL3
6	Perm	133	IH 35 @ blah blah rd	466+84	TL3
7	Phase2	133	Temp Exit ramp@Exit 127	457+42	TL3
8	Perm	133	IH 35 @ blah blah rd	466+84	TL3
9	Perm	135	IH35 @100 acre underpass	476+80	TL3

- Include enough information to identify the location specifically.

Location Information (Station)

LOC NO.	TCP PHASE	PLAN SHEET NUMBER (optional)	LOCATION DESCRIPTION OF LOCATION. (CROSS STREET, CORE, LEFT OR RIGHT, ETC)	STA APPROX. STATION NUMBER OF CC	TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS
1	Phase 1	121	IH 35 @ imaginary rd	456+32	TL3
2	Phase 2	125	Temp Exit ramp@Exit 127	457+42	TL3
3	Perm	125	IH 35 @ imaginary 2 rd	457+32	TL3
4	Phase2	126	IH35@NW corner blank crk brg	458+18	TL3
5	Phase2	132	median barrier end	460+80	TL3
6	Perm	133	IH 35 @ blah blah rd	466+84	TL3
7	Phase2	133	Temp Exit ramp@Exit 127	457+42	TL3
8	Perm	133	IH 35 @ blah blah rd	466+84	TL3
9	Perm	135	IH35 @100 acre underpass	476+80	TL3

- This is just to help identify each crash cushion.

Crash Cushion Install information

- This information is specific for each location.
- Ensures Suppliers know what transitions are necessary
- Gives contractors/suppliers opportunity to verify standards in plans will shield the obstacle properly
- Ensures designers consider each crash cushion.
- Ensures Contractor has information for bidding foundation correctly

TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (OBJECT BEING SHIELDED)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL	PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	DESCRIPTION	WIDTH	HEIGHT	
		WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE , ASPHALT, ETC			SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE	WIDEST WIDTH OF OBJECT BEING SHIELDED	HEIGHT OF OBJECT BEING SHIELDED	LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION
TL3	Bi	Asph	2"	Yes	F-Shape	24"	32"	32'
TL3	Uni	Conc	8"	Yes	LPCB	28"	20"	25'
TL3	Bi	Conc	8"	Yes	T551	17"	32"	30'
TL3	Uni	Conc	8"	Yes	T221	12"	32"	>50'
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42"	23'
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48"	42"	>50'
TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"

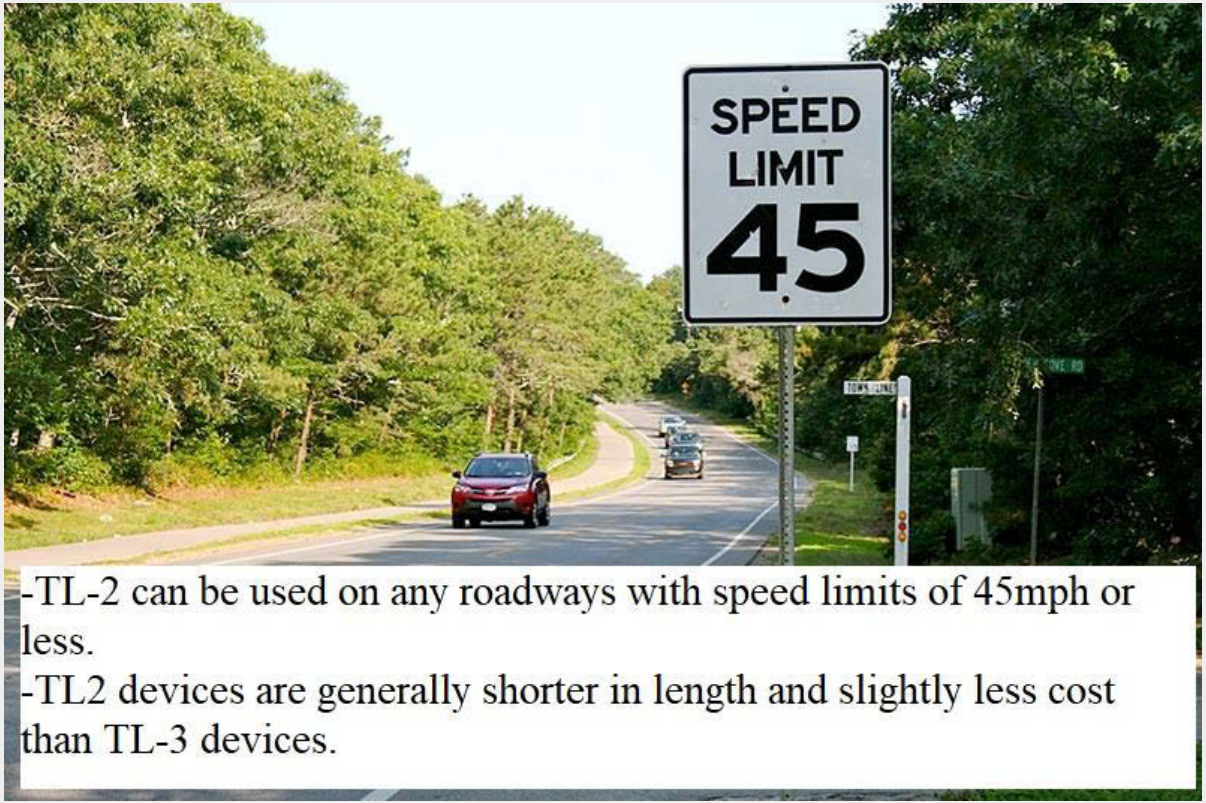
Crash Cushion Install information (Test Level)

- TL-2 crash cushions are acceptable on roadways with speed limits of 45 mph or less
- TL-3 crash cushions are acceptable for use on any speed limit roadway.

TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (OBJECT BEING SHIELDED)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL	PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	DESCRIPTION	WIDTH	HEIGHT	
		WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE , ASPHALT, ETC			SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE	WIDEST WIDTH OF OBJECT BEING SHIELDED	HEIGHT OF OBJECT BEING SHIELDED	LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION
TL3	Bi	Asph	2"	Yes	F-Shape	24"	32"	32'
TL3	Uni	Conc	8"	Yes	LPCB	28"	20"	25'
TL3	Bi	Conc	8"	Yes	T551	17"	32"	30'
TL3	Uni	Conc	8"	Yes	T221	12"	32"	>50'
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42"	23'
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48"	42"	>50'
TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"

Crash Cushion Install information (Test Level)

- Test Level 2 (TL2)



Crash Cushion Install information (Test Level)

- Test Level 3 (TL3)

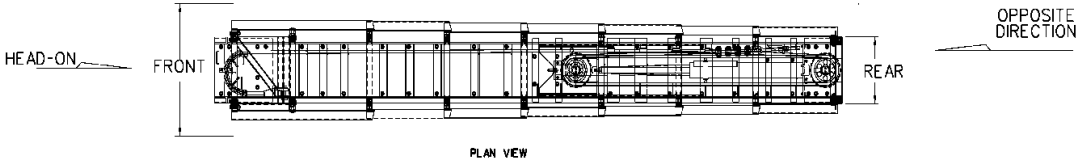
Crash Cushion Install information (Direction of Traffic)

- Bi-directional should be indicated if crash cushion will ever be unshielded within the clear zone of opposite direction traffic.
- Uni-directional should be indicated if there is no risk of the crash cushion being impacted from the back side.

TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (OBJECT BEING SHIELDED)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE , ASPHALT, ETC	PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	DESCRIPTION SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE	WIDTH WIDEST WIDTH OF OBJECT BEING SHIELDED	HEIGHT HEIGHT OF OBJECT BEING SHIELDED	LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION
TL3	Bi	Asph	2"	Yes	F-Shape	24"	32"	32'
TL3	Uni	Conc	8"	Yes	LPCB	28"	20"	25'
TL3	Bi	Conc	8"	Yes	T551	17"	32"	30'
TL3	Uni	Conc	8"	Yes	T221	12"	32"	>50'
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42"	23'
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48"	42"	>50'
TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"

Crash Cushion Install information (Direction of Traffic)

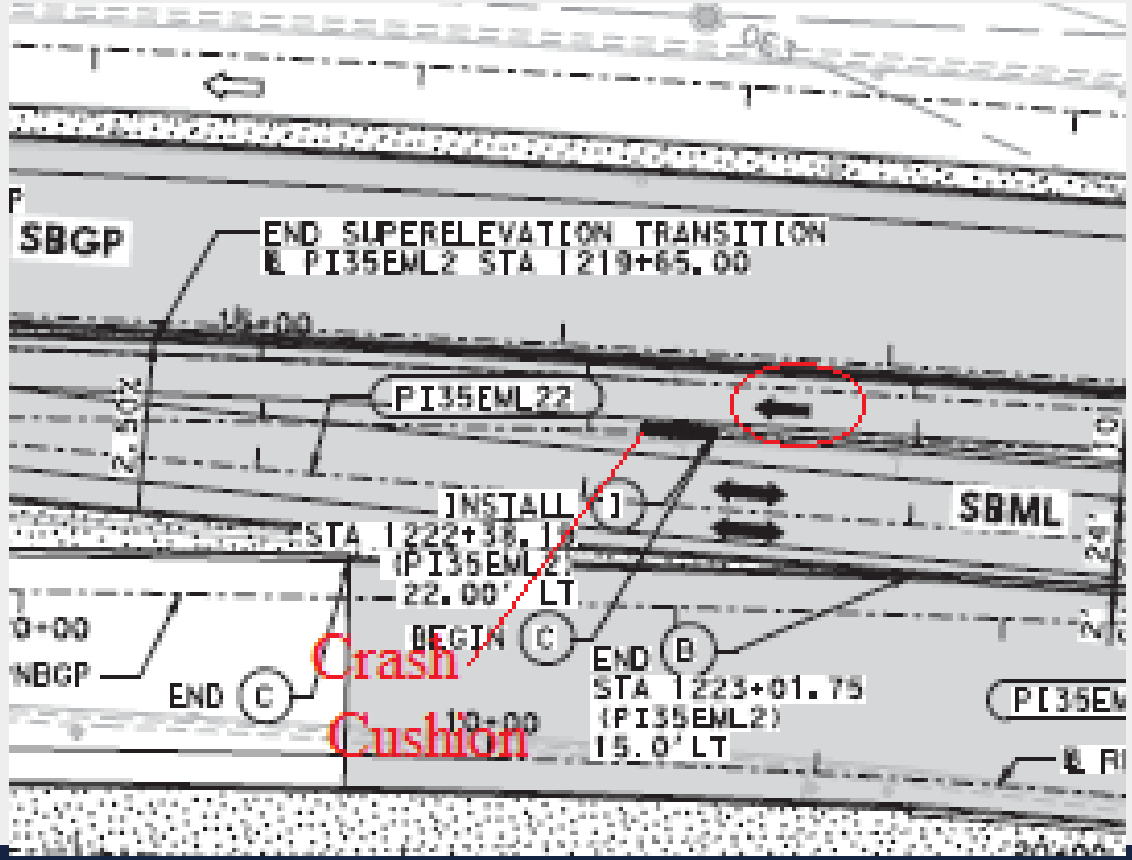
- Bi-directional should be indicated if crash cushion will ever be unshielded within the clear zone of opposite direction traffic.



PLAN VIEW

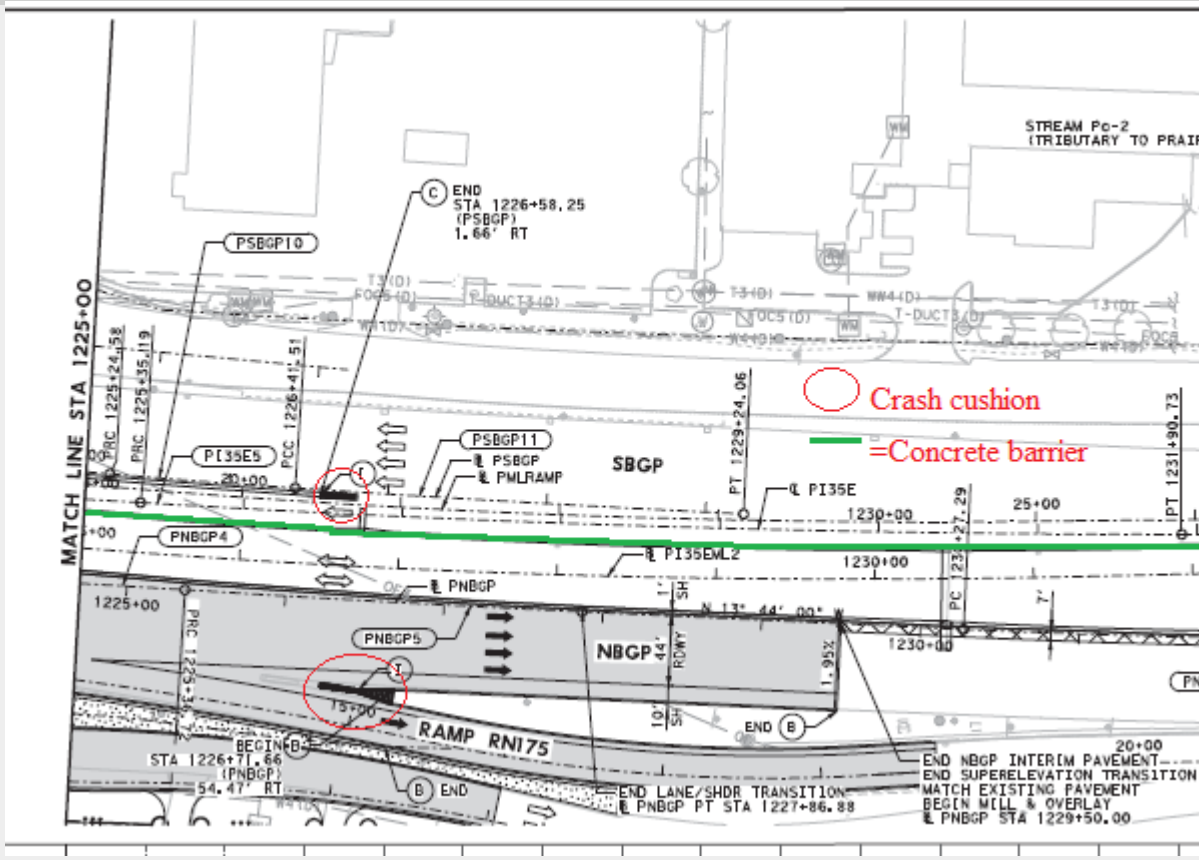
Crash Cushion Install information (Direction of Traffic)

- Bi-directional should be indicated if crash cushion will ever be unshielded within the clear zone of opposite direction traffic.



Crash Cushion Install information (Direction of Traffic)

- Uni-directional should be indicated if there is no risk of the crash cushion being impacted from the back side.



Crash Cushion Install information (foundation pad)

- Determine if a suitable foundation pad exists.
- If crash cushion will be installed on roadway surface then material and thickness can be collected from cross sections
- If crash cushion is to be installed where foundation pad is not suitable; leave proposed thickness blank or indicate to meet the standard for thickness by inserting “standard” or “meet” and indicate pad does not exist.

TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (OBJECT BEING SHIELDED)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE , ASPHALT, ETC	PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	DESCRIPTION SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE	WIDTH WIDEST WIDTH OF OBJECT BEING SHIELDED	HEIGHT HEIGHT OF OBJECT BEING SHIELDED	LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION
TL3	Bi	Asph	2"	Yes	F-Shape	24"	32"	32'
TL3	Uni	Conc	8"	Yes	LPCB	28"	20"	25'
TL3	Bi	Conc	8"	Yes	T551	17"	32"	30'
TL3	Uni	Conc	8"	Yes	T221	12"	32"	>50'
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42"	23'
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42"	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48"	42"	>50'
TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"

Crash Cushion Install information (Backup Support)

- Backup support is what is being shielded.
- Some crash cushions are self-supporting and don't require support of backup structure.
- The shape of the structure is needed to provide proper transitions.
- The width is required to ensure crash cushions selected will adequately shield obstacle.
- The height of the object being shielded informs the transition decision

TEST LEVEL	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (Object Being Shielded)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL	PROPOSED THICKNESS	Is Foundation Pad Existing (Yes/No)	DESCRIPTION	WIDTH	HEIGHT	
TL2-<45mph TL3-All speeds		*What material will the crash cushion be anchored to? Concrete , Asphalt, etc*		*Is the existing surface sufficient to anchor the crash cushion?*	*Single slope, F-shape, bridge rail type*	*Widest width of object being shielded*	*Height of object being shielded*	*longitudinal space available to install crash cushion*
T_3	Bi	Asph	2"	Yes	F Shape	24"	32"	32
T_3	Uni	Conc	8"	Yes	LPCB	28"	20"	25
T_3	Bi	Conc	8"	Yes	155'	17"	32'	30'
TL3	Uni	Conc	8"	Yes	T221	12	32"	>50'
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42'	23'
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42	>50'
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48'	42"	>50'
T_3	Bi	Conc	Standard	No	Bridge Column	36"	42'	42'

Crash Cushion Install information (Available Site Length)

- Available site length is the longitudinal length available to install crash cushion
- If site length is greater than 50’ a precise measurement is not necessary

TEST LEVEL TL2=<=45MPH TL3=ALL SPEEDS	DIRECTION OF TRAFFIC (UNI/BI)	FOUNDATION PAD			BACKUP SUPPORT (OBJECT BEING SHIELDED)			AVAILABLE SITE LENGTH
		PROPOSED MATERIAL	PROPOSED THICKNESS	IS THE EXISTING SURFACE SUFFICIENT TO ANCHOR THE CRASH CUSHION? (YES/NO)	DESCRIPTION	WIDTH	HEIGHT	
		WHAT MATERIAL WILL THE CRASH CUSHION BE ANCHORED TO? CONCRETE , ASPHALT, ETC			SINGLE SLOPE, F-SHAPE, BRIDGE RAIL TYPE	WIDEST WIDTH OF OBJECT BEING SHIELDED	HEIGHT OF OBJECT BEING SHIELDED	LONGITUDINAL SPACE AVAILABLE TO INSTALL CRASH CUSHION
TL3	Bi	Asph	2"	Yes	F-Shape	24"	32"	32’
TL3	Uni	Conc	8"	Yes	LPCB	28"	20"	25’
TL3	Bi	Conc	8"	Yes	T551	17"	32"	30’
TL3	Uni	Conc	8"	Yes	T221	12"	32"	>50’
TL3	Bi	Conc	10"	Yes	Single Slope	24"	42"	23’
TL3	Bi	Conc	Standard	Yes	Single Slope	24"	42"	>50’
TL3	Uni	Conc	Standard	Yes	Single Slope	24"	42"	>50’
TL3	Uni	Conc	Standard	Yes	Single Slope x2	48"	42"	>50’
TL3	Bi	Conc	Standard	No	Bridge Column	36"	42"	42"

Crash Cushion Install information (Available Site Length)

- L= available site length

Crash Cushion categorization information

- Ensures suppliers know how many of each category to bid
- Ensures contractors know when/where to move crash cushions during construction.
- Ensures all crash cushion actions are accounted for (Install, Remove, Move & Reset)

CRASH CUSHION										
		MOVE / RESET		L N	L W	R N	R W	S N	S W	ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION
INSTALL	REMOVE	MOVE/ RESET	FROM LOC. #							SEE TABLE
X									X	22, 24
X									X	22
X						X				10, 12, 15
	X								X	
		X	2						X	
X				X						1, 3, 5
	X								X	
X					X					2, 4, 6
X					X					4, 6

Ref.	#Low Maintenance	Ref.	# Reusable	Ref.	#Sacrificial
1	QGELITE(M10)(N)	10	QGUARD(M10)(N)	19	SSCC
2	QGELITE(M10)(W)	11	QG(M)(W)	20	CATCB(1)
3	REACT(M)	12	TAU(M)(N)	21	MATT(1)
4	REACT(W)	13	TAU-II(W)	22	ABSORB(M)
5	SMTC(N)	14	TRACC(W)	23	SLEDMINI
6	SMTC(W)	15	DELTACC	24	SLED
7	TAU-XR(N)	16		25	VIA(SFPM)
8	TAU-II-R(W)	17		26	
9		18		27	

Crash Cushion categorization information

- Each crash cushion location should be accounted for.
- L=Low Maintenance
  R=Reusable
  S=Sacrificial
  N=Narrow
  W=Wide

- Designers can add as many or as few crash cushions as desired in this column specific to each location.

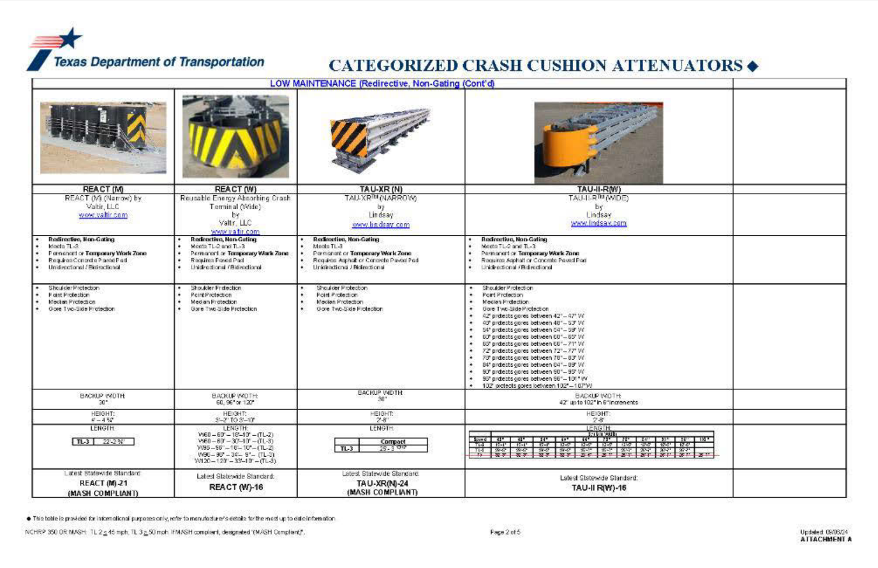
CRASH CUSHION										
		MOVE / RESET		L	L	R	R	S	S	ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION
INSTALL	REMOVE	MOVE/ RESET	FROM LOC. #	N	W	N	W	N	W	SEE TABLE
X									X	22, 24
X									X	22
X						X				10, 12, 15
	X								X	
		X	2						X	
X				X						1, 3, 5
	X								X	
X					X					2, 4, 6
X					X					4, 6

Bid Codes Explained

- CRASH CUSH ATTEN (MOVE & RESET)
  - This designates any crash cushion noted on CCSS to be moved from one location to another (Including from a stockpile).
- CRASH CUSH ATTEN (REMOVE)
  - This designates any crash cushion noted on CCSS to be removed by contractor. (Stockpile, salvage, or disposal instructions elsewhere in plans)
- CRASH CUSH ATTEN (INSTL)(X)(Y)(Z)
  - INSTL= Install Crash Cushion at location indicated on CCSS
  - X=Category (L=Low Maintenance, R=Reusable, S= Sacrificial)
  - Y=Width of crash cushion (N=narrow; W=Wide Typically>30”)
  - Z=Test Level (TL2- up to 45mph; TL3 all speed roadways)
  - Example 545 6007 CRASH CUSH ATTEN(INSTL)(L)(N)(TL3) EA

Bid Codes cont’d

- 70 mph crash cushion bid codes have been removed from bid code list
  - 70 mph was a sub category of crash cushion under the old NCHRP 350 crash testing guidance. It was never required and the tests would not be valid for the larger MASH vehicles.
  - MASH TL3 crash cushions are approved for use on all speed roadways.



Texas Department of Transportation

CATEGORIZED CRASH CUSHION ATTENUATORS ◆

LOW MAINTENANCE (Redirective, Non-Gating (Cont'd)

REACT (M)	REACT (W)	TAU-XR (N)	TAU-II-R(W)	
REACT (M) (Narrow) by Valtir, LLC www.valtir.com	Reusable Energy Absorbing Crash Terminal (Wide) by Valtir, LLC www.valtir.com	TAU-XR™ (NARROW) by Lindsay www.lindsay.com	TAU-II-R™ (WIDE) by Lindsay www.lindsay.com	
• **Redirective, Non-Gating** • Meets TL-3 • Permanent or **Temporary Work Zone** • Requires Concrete Paved Pad • Unidirectional / Bidirectional	• **Redirective, Non-Gating** • Meets TL-2 and TL-3 • Permanent or **Temporary Work Zone** • Requires Paved Pad • Unidirectional / Bidirectional	• **Redirective, Non-Gating** • Meets TL-3 • Permanent or **Temporary Work Zone** • Requires Asphalt or Concrete Paved Pad • Unidirectional / Bidirectional	• **Redirective, Non-Gating** • Meets TL-2 and TL-3 • Permanent or **Temporary Work Zone** • Requires Asphalt or Concrete Paved Pad • Unidirectional / Bidirectional	
• Shoulder Protection • Point Protection • Median Protection • Gore Two-Side Protection	• Shoulder Protection • Point Protection • Median Protection • Gore Two-Side Protection	• Shoulder Protection • Point Protection • Median Protection • Gore Two-Side Protection	• Shoulder Protection • Point Protection • Median Protection • Gore Two-Side Protection • 42" protects gores between 42" – 47" W • 48" protects gores between 48" – 53" W • 54" protects gores between 54" – 59" W • 60" protects gores between 60" – 65" W • 66" protects gores between 66" – 71" W • 72" protects gores between 72" – 77" W • 78" protects gores between 78" – 83" W • 84" protects gores between 84" – 89" W • 90" protects gores between 90" – 95" W • 96" protects gores between 96" – 101" W • 102" protects gores between 102" – 107" W	
BACKUP WIDTH: 30"	BACKUP WIDTH: 60, 96" or 120"	BACKUP WIDTH: 30"	BACKUP WIDTH: 42" up to 102" in 6" increments	
HEIGHT: 4' – 4 ½"	HEIGHT: 3'-2" TO 3'-10"	HEIGHT: 2'-8"	HEIGHT: 2'-8"	
LENGTH: TL-3 | 22'-2 ½"	LENGTH: W60 – 60" – 18'-10" – (TL-2) W60 – 60" – 30'-10" – (TL-3) W96 – 96" – 16'- 10" – (TL-2) W96 – 96" – 34'- 9" – (TL-3) W120 – 120" – 33'-10" – (TL-3)	LENGTH: Compact TL-3 | 25'- 3 [illegible]	LENGTH: [illegible]	
Latest Statewide Standard: **REACT (M)-21** **(MASH COMPLIANT)**	Latest Statewide Standard: **REACT (W)-16**	Latest Statewide Standard: **TAU-XR(N)-24** **(MASH COMPLIANT)**	Latest Statewide Standard: **TAU-II R(W)-16**	

● This table is provided for informational purposes only, refer to manufacturer's details for the most up to date information.

NCHRP 350 OR MASH: TL 2 ≤ 45 mph, TL 3 ≥ 50 mph. If MASH compliant, designated "(MASH Compliant)".

Page 2 of 5

Updated 09/06/24
ATTACHMENT A

Crash Cushion Standards

- Non-MASH crash cushion standards should only be used in situations where a MASH approved crash cushion option will not adequately shield the obstacle.(generally that means Non-MASH Crash Cushions will be sole sourced)
- Non-MASH crash cushions will eventually be removed from the approved list.
- Crash cushion standards for each location should include at least 2 standards (from the chosen category) or a sole source memo explaining why the selected standard should be sole sourced.
- Engineer should evaluate each location and include any standard from that category he/she selected that they deem relevant.

Example

- Based on example CCSS we are installing 2 Sacrificial Narrow crash cushions, 1 reusable –narrow, 1 Low Maintenance-narrow, and 2 Low Maintenance-Wide. Move and reset 1 sacrificial-narrow. Remove 2 sacrificial-narrow.
- The corresponding Bid codes and quantities are

BID CODE	DESCRIPTION	UNITS	QUANTITY
545-6003	CRASH CUSH ATTEN(MOVE &RESET)	EA	1
545-6005	CRASH CUSH ATTEN(REMOVE)	EA	2
545-6007	CRASH CUSH ATTEN(INSTL)(L)(N)(TL3)	EA	1
545-6010	CRASH CUSH ATTEN(INSTL)(L)(W)(TL3)	EA	2
545-6013	CRASH CUSH ATTEN (INSTL)(R)(N)(TL3)	EA	1
545-6019	CRASH CUSH ATTEN(INSTL)(S)(N)(TL3)	EA	2

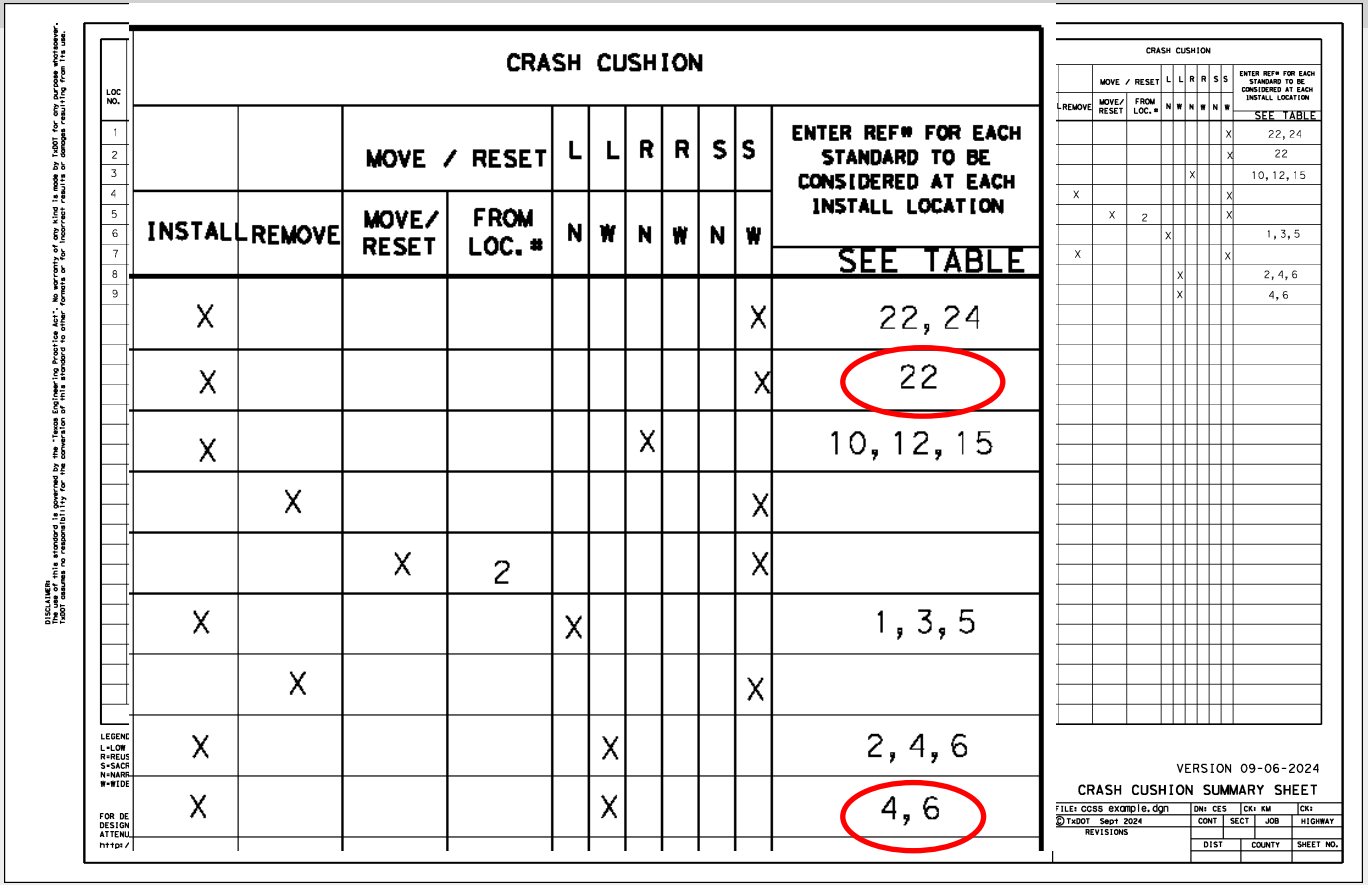
EXAMPLE cont'd

- STANDARD SHEETS ARE ONLY REQUIRED FOR THE "INSTALL" LOCATIONS.

Loc. #	CC Info	Standards Selected
1	TL3,S, Narrow	ABSORB(M)-19, SLED-19
2*	TL3,S,Narrow	ABSORB(M)-19
3	TL3,R,Narrow	QGUARD(M10)(N)-20, TAU(M)(N)-19, DELTACC-22
6	TL3,L,Narrow	QGELITE(M10)(N)-20, REACT(M)-21, SMTC(N)-16
8	TL3,L,WIDE	QGELITE(M10)(W)-20, SMTC(W)-16, REACT(W)-16
9*	TL3,L,WIDE	REACT(W)-16, SMTC(W)-16

- *Locations 2 and 9 on the ccss should reflect the reduced number of crash cushions available per the designer.

Example Cont'd



CRASH CUSHION

LOC NO.	INSTALL	REMOVE	MOVE / RESET: MOVE/ RESET	MOVE / RESET: FROM LOC. #	L N	L W	R N	R W	S N	S W	ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION
											SEE TABLE
1	X									X	22, 24
2	X									X	22
3	X						X				10, 12, 15
4		X								X	
5			X	2						X	
6	X				X						1, 3, 5
7		X								X	
8	X					X					2, 4, 6
9	X					X					4, 6

LEGEND
L=LOW
R=REUS
S=SACR
N=NARR
W=WIDE

FOR DE
DESIGN
ATTENU

DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

CRASH CUSHION

REMOVE	MOVE / RESET: MOVE/ RESET	MOVE / RESET: FROM LOC. #	L N	L W	R N	R W	S N	S W	ENTER REF# FOR EACH STANDARD TO BE CONSIDERED AT EACH INSTALL LOCATION
									SEE TABLE
								X	22, 24
								X	22
				X					10, 12, 15
X								X	
	X	2						X	
			X						1, 3, 5
X								X	
				X					2, 4, 6
				X					4, 6

VERSION 09-06-2024

CRASH CUSHION SUMMARY SHEET

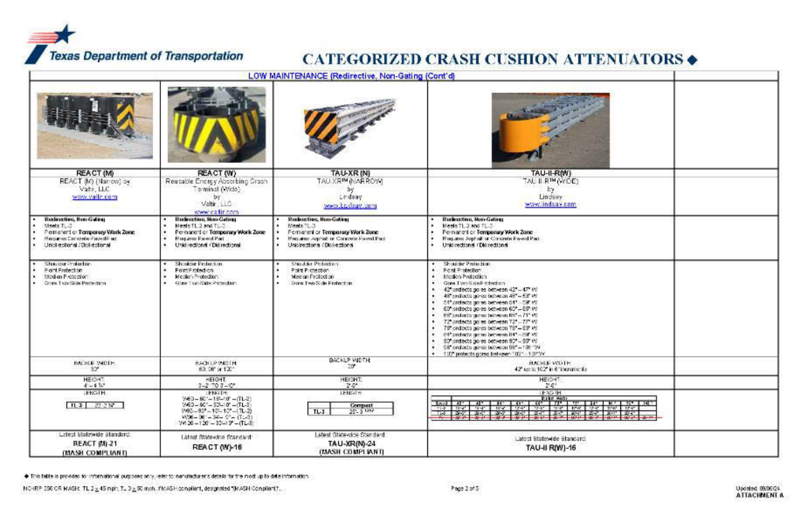
FILE: ccss example.dgn	DN: CES	CK: KM	CK:
©TxDOT Sept 2024	CONT	SECT	JOB
REVISIONS			HIGHWAY
	DIST	COUNTY	SHEET NO.

Some high points to remember from this training

- Crash Cushion Summary Sheet, Bid Codes and Standard Sheets selected should match.
  - The category selected for each crash cushion should be reflected on the CCSS, bid codes, and standard sheets selected for the plans
- TxDOT plans control what suppliers and contractors supply for the project.
  - If bi-directional traffic is indicated on the CCSS a transition will be provided and included in the price. If bi-directional is not indicated the contractor/supplier doesn't know to provide a transition.
  - The plans dictate what crash cushions are bid and supplied. The bid and what is supplied is only as good as the information provided.
- It is easier to get the crash cushion information correct in the plans than during construction.

Tools Available

- Crash cushion summary sheet
- Crash cushion categorization sheet
  - https://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/standard/roadway/cccc.pdf
  - Crash cushion categorization sheet includes information on each crash cushion. Physical dimensions, manufacturer information, uses, etc.



Questions

- Please Contact Design Division for questions or comments.
  - Chris Lindsey 512-416-2750
  - Kenneth Mora 512-416-2678

*This Webinar is being recorded and will be posted to the Design Division website.

Crash Cushion Webinar (9-24-24) Questions and Responses

Q- Mark Herber: FWIW, the DES index of sheets spreadsheet with pen tables could be used to fill in the sheet numbers automatically.

- A- Good comment. We are working with other groups to make this happen.

Sandy Morris: slide 22 - is a clam shell sufficient transition

A- Transitions are specific to each crash cushion so, I can't say for certain what transitions are acceptable as a general rule. If the crash cushion summary sheet is filled out correctly there should be enough information for the contractor to get an appropriate transition.

Jim Langston: Slide 22 - maybe a little more on the "transition". Does this indicate LON and thrie-beam type transition could be required?

A- Many crash cushions have multiple transitions. Again, transitions are specific to each crash cushion. Some crash cushions have transitions to single slope barrier, F shape barrier, vertical wall, Thrie beam, W- Beam. I guess technically the transitions are redirective so they would contribute to Length of Need.

Joshi Bhupesh: Is there an excel sheet developed or being developed for the summary sheet? Especially when we're using ORD now, it would be great to link it with a spreadsheet thru Axiom or ORD in-built import tool as well.

A- An Excel spreadsheet does not exist yet, but we will talk to other groups to help make this happen.

Tim Newton: Will you be posting the slides from the webinar from today? Thanks

A- The slides, the recording, and the answers to the questions should all be posted on the DES Website soon.

Amita Mehta: Excel sheet format of CC summary will be great idea , as its easy to follow.

A- Good Comment. We will be working on this.

Lane Brister: With the new reference table placed on the bottom of the sheet there is not much room to place the final engineering seal. How do you recommend to place them?

A- The Crash Cushion Summary Sheet does not need to be signed and sealed.

Jim Reiser: When we analyze whether or not bidirectional CCA's are needed, may we use the clear zone dimension as a guide as to whether or not the CCA is too close to opposing traffic?

A- The clear zone is a great guide. You can use it as a hard and fast rule, but my recommendation would be to use it as a guide and evaluate each situation.

William Rickey: Will Crash Cush Attenuators be more involved in Schematic design going forward? I have seen recent comments from the division about including Crash Cush Atten/MBGF in the schematic design.

A- The crash cushions/MBGF are generally not required to be shown on a schematic. If they are shown and there is a possible issue (e.g., shoulder width) a comment may be provided.

Stephen Smiley: Nested side plates are like scales on a fish/dragon. When struck in counterflow direction, do they become threat of vehicle intrusion/spearing hazard?

A- I would say as long as a crash cushion is not repaired a reverse direction impact could result in spearing.

Mariel Torres: Does the engineer need to provide signed/sealed details for the connection of transition to the crash cushion? Or does the standard detail suffice?

A- We are not requiring the designer to specify the specific transition. Since there are so many crash cushions and multiple transitions per crash cushion it is not realistic to expect the designer to choose the transitions for each location. We expect that if the crash cushion summary sheet is filled our correctly that the contractor has enough information to provide the correct transition.

Tony Smiley: Thoughts on TL2 Vs TL3 systems on entrance ramps off a service road. Service roads are often at 45 but the entrance ramps is going onto a much higher road speed

A- My personal recommendation is to install TL3 unless TL3 won't fit in the location.

Sandy Morris: what rule of thumb offset from edge of traveled way to crash cushion should be used?

A- We (Design Division) haven't weighed in on this. But, this may be something that we will look at in the near future.

Heath Bozeman: Also have had issue on MBGF extruders going that the MBGF going around and penetrating into a vehicle. But it still safer to have them than not.

A- Agreed.

Ayoub Osama: In managing CCAs across multiple traffic control phases, I installed 30 CCAs in the first phase, reduced to 20 in the second phase (removing 10), and then needed to increase to 40 in the third phase. In that case, would it be efficient to store the 10 unused CCAs and reuse them for the third phase, and if so, is there a bid item for storing CCAs?

A- It could be more efficient to store the crash cushions in a stockpile location, but that would depend on how far away the stockpile location is from the construction. The bid code for that would be to "Remove" crash cushion to the stockpile location and then "Move and reset" from a stockpile location to install crash cushions from a stockpile location.

Gaston Ibarra: We have encountered several locations where driveways are located near ends of bridges/obstacles that need to be protected and LON cannot be met or the crash cushion encroaches into the driveway. Is there any guidance/suggestions on what type of crash cushion to be used in these instances?

A- There really is no general guidance for these situations. Several factors come into play and will need to be considered (ie. How much space is available, what is being shielded, can the crash cushion be flared, etc).

Michael Brinkley: The 2024 standard specifications add a category for Work Zone attenuators. The specification and pay items show these as a 4th category outside the "Low Maintenance-Reusable-Sacrificial" categories. Is this a pay item we should be using at this point for Work Zone applications?

A- Yes apparently we should be using that bid code. This may warrant us making changes to the Crash cushion Summary Sheet and the Crash cushion categorization chart.

Heath Bozeman: Use Engineering judgment. Sometimes we have limited areas that the devices will not be able to fit.

A- Agreed

Genesaret Brown: In what scenario would we use a TL-2 on a foundation that isn't listed or verified and have sand or gallons of water as the anchor to hold it down? Just asking I have seen it out on the Roadways in Dallas.

A- While the weight of the sand or water do anchor those crash cushions in some ways, it is not a foundation pad and does not require noting. The purpose of the “foundation pad” section on the crash cushion summary sheet is to let the contractor know if they will need to pour a foundation to anchor the crash cushion. Neither water filled crash cushions nor sand barrels require anchoring to a foundation pad so if water filled crash cushions or sand barrels are the only options for a location I recommend either indicating “yes” the foundation pad is sufficient or leaving it blank. Essentially the contractor doesn’t have to pour a foundation pad and doesn’t need to include a foundation pad in their bid.

Chris Strunk: Do you have any advice for type of crash cushion to install on a bridge to protect CTB across a future offramp in a subsequent phase of the project (years in the future). Are crash cushions that require drilling/anchoring into new bridge deck acceptable or would sand barrels be preferred? I've seen guidance that mentions that vibrations on bridge decks may cause sand barrels to shift over time.

A- In my experience vibration will cause the sand barrels to move. I try not to drill or anchor into bridge deck unless it is absolutely necessary. But, it is technically not restricted to anchor on a bridge deck. As far as what crash cushion to specifically use in this situation, I try not to make recommendations without knowing the specifics of the situation.

Stephen Smiley: Does Work Zone classification automatically imply payment both Install & Remove?

A- In the 2024 Item 545 specifications there is a distinction between crash cushions that will ultimately be installed Permanently in a project, and a crash cushion used exclusively in a TWZ application. The DES SOURCE, Move & Reset, STKPL, and Remove bid codes will still be

used as needed after the initial Installation whether it be a Permanent INSTL, or TWZ INSTL. See Item 545 bid codes below.

```
0545 7001 CRASH CUSH ATTEN (DES SOURCE)           EA
0545 7002 CRASH CUSH ATTEN (MOVE & RESET)         EA
0545 7003 CRASH CUSH ATTEN (STKPL)                EA
0545 7004 CRASH CUSH ATTEN (REMOVE)               EA
0545 7005 CRASH CUSH ATTEN (INSTL)(L)(N)(TL2)     EA
0545 7006 CRASH CUSH ATTEN (INSTL)(L)(N)(TL3)     EA
0545 7007 CRASH CUSH ATTEN (INSTL)(L)(W)(TL2)     EA
0545 7008 CRASH CUSH ATTEN (INSTL)(L)(W)(TL3)     EA
0545 7009 CRASH CUSH ATTEN (INSTL)(R)(N)(TL2)     EA
0545 7010 CRASH CUSH ATTEN (INSTL)(R)(N)(TL3)     EA
0545 7011 CRASH CUSH ATTEN (INSTL)(R)(W)(TL2)     EA
0545 7012 CRASH CUSH ATTEN (INSTL)(R)(W)(TL3)     EA
0545 7013 CRASH CUSH ATTEN (INSTL)(S)(N)(TL2)     EA
0545 7014 CRASH CUSH ATTEN (INSTL)(S)(N)(TL3)     EA
0545 7015 CRASH CUSH ATTEN (INSTL)(S)(W)(TL2)     EA
0545 7016 CRASH CUSH ATTEN (INSTL)(S)(W)(TL3)     EA
0545 7017 CCA (INSTL)(N)(TL2)(WORK ZONE)          EA
0545 7018 CCA (INSTL)(N)(TL3)(WORK ZONE)          EA
0545 7019 CCA (INSTL)(W)(TL2)(WORK ZONE)          EA
0545 7020 CCA (INSTL)(W)(TL3)(WORK ZONE)          EA
```

Sandy Morris: does txdot maintenance have a specific required timeline window for replacing damaged attenuator?

A- It varies, but the maintenance manual states that devices should be replaced or repaired as soon as practical.

Stephen Smiley: An array of sand barrels is likely **too heavy** to allow on a bridge deck.

A- Good information

Chris Strunk: I have seen them at various locations in similar situations, Usually on direct connectors. Great information/presentation - thanks y'all.

A- Good Comment