



ટ્રાફિક શાખા માટે વાર્ષિક ઇજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (યુનિટ રેટ)

આ સાથે ડ્રાફ્ટ ટેન્ડર ના ૧ થી ૨૦૧ પેજ આ સાથે સામેલ છે. જેમાં સહી થઈ આવવા વિનંતી છે.

નં.કા.ઈ

કા.ઈ.

ટ્રાફિક શાખા

ટ્રાફિક શાખા

**OFFICE OF
THE EXECUTIVE ENGINEER,
TRAFFIC DEPARTMENT
V.M.C**

PRE-QUALIFICATION-BID

NAME OF WORK

ટ્રાફિક શાખા માટે વાર્ષિક ઈજરાતી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (યુનિટ રેટ)



વડોદરા મહાનગરપાલિકા

www.vmc.gov.in

વડોદરા મહાનગરપાલિકાના યોગ્ય વિભાગ તેમજ યોગ્યશ્રેણીમાં નોંધાયેલ ઇજારદારો પાસેથી તથા સરકારી/અર્ધસરકારી સંસ્થાના નોંધાયેલ અનુભવી ઇજારદારો પાસેથી નીચે જણાવેલ કામો માટે મહોરબંધ ભાવપત્રો (પ્રી-કવોલીફિકેશન બીડ) રજી.પોસ્ટ એડી/ સ્પીડપોસ્ટથી મંગાવવામાં આવે છે.

અંદાજ રકમ રૂ.	બાનાની રકમ રૂ.	ટેન્ડરની ફી	ટેન્ડર વિતરણની છેલ્લી તારીખ	ટેન્ડર સ્વીકારવાની છેલ્લી તારીખ	વધુ માહિતી માટે વિભાગ
૧) કામનું નામ :-દ્રાફ્ટ શાખા માટે વાર્ષિક ઇજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પદ્મ પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ.					
રૂ.૫.૦૦ કરોડની મર્યાદામાં	૧૦,૦૦,૦૦૦/-	૨૦,૦૦૦/-	૨૯-૦૬-૨૦૨૬	૨૯-૦૬-૨૦૨૬	દ્રાફ્ટ શાખા

ઉપરોક્ત જાહેરાતમાં દર્શાવેલ તમામ કામો માટેના કોરા ટેન્ડર ફોર્મ તથા કામની વિસ્તૃત માહિતી અત્રેની કચેરીએથી મળી શકશે. વડોદરા મહાનગરપાલિકાની ઉપર જણાવ્યા મુજબની વેબસાઇટ પરથી માહિતી તેમજ ટેન્ડર ફોર્મ ડાઉનલોડ કરી ભરીને જાહેરાતના ટેન્ડર ડોક્યુમેન્ટમાં દર્શાવ્યા મુજબ ઇ-ટેન્ડરીંગથી ભરેલા ટેન્ડરના પ્રી-બીડ ડોક્યુમેન્ટની સોફ્ટ કોપી દ્વારા જ ઓનલાઇન ફક્ત ઇ-ટેન્ડરીંગ પદ્ધતિથી www.nprocure.com વેબસાઇટ પરથી ટેન્ડર ભરવાનું રહેશે. ત્યારબાદ સોફ્ટ કોપીના આધારે જ તેનું ઇવોલ્યુએશન કરવામાં આવશે, ઇજારદારે ભરેલા ટેન્ડરના પ્રી-બીડ ડોક્યુમેન્ટની હાર્ડ કોપી પણ રજૂ કરવાની રહેશે. **પ્રી-બીડ મીટીંગ તા-૧૯-૦૬-૨૦૨૬ નાં રોજ બપોરે ૦૪:૩૦ વાગે** દ્રાફ્ટ શાખા , પહેલો માળ , કુમાર શાળા -૦૧ , ફુલીરામ પેંડાવાળાની સામે , રાવપુરા

તમામ બીડરે ટેન્ડર ફીની રકમના ડી.ડી.તેમજ ૨% અનામતની રકમના ડિમાન્ડ ડ્રાફ્ટ/બેંક ગેરંટી અનુક્રમ નં ૧ માટે **તા.૦૧.૦૭.૨૬** ના રોજ સદર ઉપરોક્ત કામની હાર્ડ કોપી રજી.પોસ્ટ એડી/સ્પીડ પોસ્ટથી કાર્યપાલક ઇજનેર,દ્રાફ્ટ પ્રોજેક્ટ શાખા , કુમાર શાળા નં ૧, ફુલીરામ પેંડાવાળાની સામે, રાવપુરા, ૩૯૦૦૦૧ વડોદરા ખાતે મોકલવાની રહેશે. તેમજ કોઇપણ ભાવપત્ર મંજૂર નામંજૂર કરવાની અબાધિત સત્તા મ્યુનિસિપલ કમિશ્નરશ્રીની રહેશે.

પી.આર.ઓ.નં: **-૧૭૧ / ૨૬-૨૭.**

કા.ઇ.(દ્રાફ્ટ શાખા)

પ્રતિ,

જનસંપર્કઅધિકારીશ્રી,

જનસંપર્ક વિભાગ

વડોદરા મહાનગરપાલિકા

સદર જાહેરાત દૈનિક સમાચારપત્રોમાં તથા વેબસાઇટ તથા દૈનિક પેપરમાં પ્રસિધ્ધ કરવા વિનંતી છે..

કાર્યપાલક ઇજનેર

દ્રાફ્ટ શાખા

વડોદરા મહાનગરપાલિકા

Tender P.R.O. No.	Department	Details	Download of Tender		Last date of Receipt of Tender document by post
			Start Date	End Date	
	Executive Engineer (Traffic Dep. VMC)	Annual Rate Contract For hot applied thermoplastic paint and installing various road furniture in various areas for Traffic department (Unit Rate)	15-06-2026	29-06-2026	01-07-2026 (Up to 16:00 Hrs.)



વડોદરા મ્યુનિસિપલ કોર્પોરેશન

પ્રી-કવોલીફિકેશન બીડ

કામનું નામ:- ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (યુનિટ રેટ)

અંદાજીત રકમ નેટ રૂ:- ૫.૦૬ કરોડની મર્યાદામાં.

૨% અનામત :- રૂ. ૧૦,૦૦,૦૦૦/-

પ્રી-કવોલીફિકેશન દસ્તાવેજો-પત્રો

ભાવપત્ર n-PROCURE પર જમા કરવાની છેલ્લી તારીખ: ૨૯/૦૬/૨૦૨૬

ભાવપત્ર (P.Q.) હાર્ડ કોપીમાં જમા કરવાની છેલ્લી તારીખ: ૦૧/૦૭/૨૦૨૬

ભાવપત્ર મેળવનાર ઈજારદાર: -----

કાર્યપાલક ઈજનેર
(ટ્રાફિક શાખા)
વડોદરા મ્યુનિસિપલ કોર્પોરેશન



વડોદરા મ્યુનિસિપલ કોર્પોરેશન

ખાતુ/શાખા: (ટ્રાફિક શાખા)

(૧) ટેન્ડર ક્રમાંક: _____

(૨) ટેન્ડર ફી રીસીપ્ટ ક્રમાંક : _____

(૩) કામનું નામ: ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ (યુનિટ રેટ)

(ખાતાનીપ્રત)

કલાર્ક

શાખા : ટ્રાફિક શાખા
વડોદરા મ્યુનિસિપલ કોર્પોરેશન



વડોદરા મ્યુનિસિપલ કોર્પોરેશન

ખાતુ/શાખા: (ટ્રાફિક શાખા)

(૧) ટેન્ડર ક્રમાંક: _____

(૨) ટેન્ડર ફી રીસીપ્ટ ક્રમાંક : _____

(૩) કામનું નામ: : : ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ (યુનિટ રેટ)

(ઈજારદાર/અરજદારની પ્રત)

પ્રી-કવોલીફિકેશન બીડ સાથે સામેલ રાખી મોકલવી

કલાર્ક

શાખા: ટ્રાફિક શાખા
વડોદરા મ્યુનિસિપલ કોર્પોરેશન

કામનુ નામ: ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (ચુનિટ રેટ)



વડોદરા મહાનગરપાલિકા

શાખા : ટ્રાફિક શાખા

ચુનિટ રેટનુ ભાવપત્ર

ટેન્ડરફી રૂ.૨૦,૦૦૦/-

સ્ટેમ્પ ડ્યુટી રૂ.૩૦૦/-

ટેન્ડર ક્રમાંક ::

સામાન્ય સુચનાઓ

ભાવપત્રક તથા તેની શરત

ઈજારદારની જાણ માટે સામાન્ય નિયમો તથા સુચના

૧. જ્યારે કોઈ પણ મંડળ તરફથી ભાવપત્રક (Tender) ભરવામાં આવે ત્યારે તે મંડળના દરેક ભાગીદારે તેના ઉપર સહી કરવી જોઈએ ને આવી રીતે કોઈ ભાગીદાર ગેરહાજર હોય તો તેના વતી તેના કાયદેસર મુખત્યારે સહી કરવી જોઈએ.
૨. (કંપની) મંડળી તરફથી થનાર કામોના નાંણા લીધાની પાવતી ઉપર પણ મંડળના દરેક ભાગીદારની સહી થવી જોઈએ. માત્ર જ્યારે કોઈ કામના ભાવપત્રકમાં (મંડળી) કંપનીના નામથી જ કામ રાખેલું હોય તેવા પ્રસંગે તે મંડળી વતી કોઈ એક ભાગીદાર અગર તો કાયદેસર રીતે પાવતી આપવી જેને અધિકાર હોય એવો મુખત્યાર સહી કરી શકશે.
૩. ભાવપત્રક ભરતી વખતે માંગણી કરનાર ઈજારદારે આપેલા નમુનામાં પોતે કેટલા ટકા વધારે અગર ઓછા (પ્રમાણભૂત ભાવપત્રક અગર અંદાજ પત્રકના ભાવો ઉપર) ભાવથી કામ રાખવા ખુશી છે. તે દર્શાવેલ જોઈએ અને તે ઓછા અગર વધુ ટકાવારી દર્શાવેલ ભાવ અંદાજપત્ર ની તમામ રકમ માટે જ હોવા જોઈએ
૪. જાહેરનામામા જણાવેલી કામની વિગતોમાં અગર કામ પુરૂ કરવાની મુદતમાં અગર બીજી કોઈપણ વિગતોના ફેરફાર દર્શાવનાર ભાવપત્રક સ્વીકારવામાં આવશે નહીં
૫. અપુર્ણ અગર છેકછાકવાળું ભાવપત્રક સ્વીકારવામાં આવશે નહીં
૬. એક થી અધિક કામો એકમ કરી તેની ભાવપત્રક માંગવામાં આવ્યા ન હોય તે સિવાય અન્ય પ્રસંગે કોઈ પણ ભાવપત્રક માં એક થી વધારે કામોનો સમાવેશ થઈ શકશે નહીં.
૭. માંગણી કરનાર જે કામની માંગણી કરી હોય તે કામનુ નામ તથા પોતાનું અગર મંડળી નું નામ તેમજ બાનાની રકમ ભર્યા બદલનો શેરો ભાવપત્રક વાળા પાકિટની બહારની બાજુએ કરવો જોઈએ.
૮. ભાવપત્રો લેવા માટે મુકરર કરેલ વખત પછી રજુ થયેલા ભાવપત્રો વિલંબ જુજ કોઈ વિલંબના કારણો સંતોષકાર હોવા સિવાય સ્વીકારવામાં આવશે નહીં પણ આવી રીતે રજુ થયેલ ભાવપત્રો કોઈ પણ ભાવપત્ર ખોલતા અગાઉ આવેલા હોવા જોઈએ.

૯. સમિતી અગર સભાના અધિકારીના ભાવપત્રો ૧૨૦ દિવસની અંદર અને બાકીના વધારેમા વધારે ૯૦ દિવસની અંદર ભાવપત્રો મંજૂર અથવા નામંજૂર કરવામાં આવશે. સદરહું મુદત વિત્યા બાદ ઈજારદારને પોતાનું ભાવપત્રક પરત લેવા અને બાનાની રકમ પાછી માંગવાની છુટ છે. (પરિપત્ર ૨૦/તા ૧-૧૧-૦૬) ટેન્ડરની વેલીડીટી, ટુ-બીડ સીસ્ટમમાં પ્રાઈઝબીડ ખોલ્યાની તારીખથી વેલીડીટી ગણવાની રહેશે (સીટી એન્જીનીયરશ્રીની કચેરીનો પરીપત્ર અંક ૦૩/૨૦૨૨-૨૩ તા.૩૦.૦૬.૨૦૨૨ મુજબ)
૧૦. કામોના કરારો રીતસર ગુજરાત સરકારના ઠરેલા ધોરણ અનુસાર યોગ્ય રકમની સ્ટેમ્પ ટીકીટો વાળા કાગળ ઉપર થવા જોઈએ અને તેનો ખર્ચો ઈજારદારને સોંસવો જોઈએ.
૧૧. વધુ મુદ્દત મંજૂર થવા બાબતની માંગણીઓ કામ પુરૂ થવાની તારીખથી એક માસની અંદર સ્વીકારવામાં આવશે અને એક માસ પછી અને ત્રણ માસની અંદર સબળ કારણો હશે તો સ્વીકારવામાં આવશે. ત્રણ માસ પછી માંગણીઓ સમગ્ર સભાની મંજૂરી સિવાય સ્વીકારવામાં આવશે નહીં.
૧૨. ઈજારદારો જેમના સગા વડોદરા મહાનગર પાલિકાના બાંધકામ અગર રસ્તા શાખામાં નોકરીમાં હોય તેઓ તેમની નોકરીની ભૌગોલિક સ્થળ સીમાની અંદર કામો રાખી શકશે નહીં. કારણ સગપણને લીધે સંગીન દેખરેખ રાખી શકશે નહીં.
૧૩. ભાવપત્રક મંજૂર કરવું અગર નામંજૂર કરવું એ જે તે અમલદરની મુનસુફી ઉપર રાખવામાં આવે છે. અને કોઈ પણ ભાવપત્રક ભરનાર નામંજૂર ના કારણો માંગી શકશે નહીં.
૧૪. માંગણી કરનારે કામની વિગતો જેવી કે વડોદરા મહાનગર પાલિકામાંથી માલસામાન આપવામાં આવવાનો હોય તો તે નકશા કામ કરવાની વિગતો (Specification) વિગેરેની માહિતી સારી રીતે લીધેલી છે. એમ માનવામાં આવી તે તેને બંધનકાર ગણાશે.
૧૫. ઠરાવેલ વખતે અને સ્થળે આવેલા ભાવપત્રો જે ઈજારદારો અગર તેમના પ્રતીનીધી વિગેરે સમયે હાજર તેમની સમક્ષ ખોલવામાં આવશે.
૧૬. માંગણીદારો એ ખાતાના નિતી નિયમો, વખતો વખતની દુરસ્તીઓ તથા કામની પદ્ધતિ સંબધી લાગતી તમામ બાબતોથી વાકેફગદાર રહેવું જોઈએ. સદરહું નિયમો તેમને માન્યતા વગર અપવાદે બંધનકારક ગણાશે.
૧૭. ઓનલાઈન મંગાવવામાં આવતા ભાવપત્રોમાં હાર્ડકોપી આવ્યા બાદ જ પ્રિલીમીનરી સ્ટેજ ખોલવાનું રહેશે જો ઈજારદાર દ્વારા હાર્ડ કોપી જમા કરેલ ન હોઈ તો તેઓને છ માસ માટે વડોદરા મહાનગરપાલિકામાં ટેન્ડરો ભરવા માટે પ્રતિબંધિત (Abeyance) કરવાના રહેશે. (સામાન્ય વહિવટ વિભાગ પરીપત્ર અંક ૨૨/૨૦૨૨-૨૩ તા.૦૪.૦૧.૨૦૨૩ મુજબ)
૧૮. સંયુક્ત નિયામક ,ઔદ્યોગિક સલામતી અને સ્વાસ્થ્યની કચેરીના તા. ૧૩.૦૪. ૨૦૨૩ ના પરિપત્ર મુજબ મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારનું નિયમન અને નોકરીની શરતો)ના અધિનિયમનું પાલન કરવાનું રહેશે. જેનો પરિપત્ર નીચે સામેલ રાખેલ છે.

ઓનલાઈન મંગાવવામાં આવતા
ભાવપત્રોમાં, હાર્ડ કોપી આવ્યા બાદ જ
પ્રિલીમીનરી સ્ટેજ ખોલવા બાબત.

વડોદરા મહાનગરપાલિકા
કમિશ્નરશ્રીની કચેરી
સામાન્ય વહીવટ વિભાગ,
પરિપત્ર અંક:૨૨/૨૦૨૨-૨૩
તા.૦૪-૦૧-૨૦૨૩.

સા.વ.વિ.જા.નં.૩૨૪/તા:૦૪-૦૧-૨૦૨૩.

વડોદરા મહાનગરપાલિકાના વિવિધ વિભાગો દ્વારા N-procure ના માધ્યમથી ઓનલાઈન ભાવપત્રો મંગાવવામાં આવે છે. અનુભવે એવું જણાય આવેલ છે કે, કેટલાક વિભાગો દ્વારા ભાવપત્રોની હાર્ડકોપી આવ્યા પહેલા N-procure ઉપર પ્રિલીમીનરી સ્ટેજ પર સ્કુટીનીટી ન થઈ શકતી હોવા છતાં પણ પ્રિલીમીનરી સ્ટેજ ખોલવામાં આવે છે. જેથી ભાવપત્રોની ગુપ્તતા જળવાતી નથી અને તંદુરસ્ત સ્પર્ધા થઈ શકે તેમ નથી. તેમજ ઓનલાઈન મંગાવવામાં આવતા ભાવપત્રોમાં ઈજારદાર દ્વારા સોફ્ટ કોપીમાં N-procure પર ભરવામાં આવે છે. જ્યારે અમુક કિસ્સાઓમાં ઇરાદાપૂર્વક હાર્ડ કોપી જમા કરવામાં આવતી નથી.

આચંદેથી વિવિધ વિભાગો દ્વારા N-procure ના માધ્યમથી ઓનલાઈન મંગાવવામાં આવતુ ભાવપત્રોમાં, હાર્ડ કોપી આવ્યા બાદ જ પ્રિલીમીનરી સ્ટેજ ખોલવાનું રહેશે. અન્યથા જવાબદાર અધિકારી/કર્મચારી સામે શિક્ષાત્મક પગલા ભરવામાં આવશે તથા જો ઈજારદાર દ્વારા હાર્ડ કોપી જમા કરેલ ન હોય તો તેઓને આગામી છ માસ માટે વડોદરા મહાનગરપાલિકામાં ટેન્ડરો ભરવા માટે પ્રતિબંધિત (Abeyance) કરવાના રહેશે. જેની મંજૂરી જે તે વિભાગે મ્યુનિસિપલ કમિશ્નરશ્રીની મેળવવાની તકેદારી રાખવાની રહેશે.

ઉપરોક્તનો અમલ તમામ સંબંધકર્તાઓએ બિનચૂક કરવાનો રહેશે.

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નકલ રવાના: શ્રી તરફ
જાણ તથા અમલ થવા સારું.

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વહીવટી
મહેશ

મુદ્રા/નામ/	તારીખ
વડોદરા મહાનગર પાલિકા	04 JAN 2023
સી.નં.	2231

વહીવટી અધિકારી
મહાનગરપાલિકા
વડોદરા

To file
નિર્ણય



સંયુક્ત નિયામક, ઔદ્યોગિક સલામતી અને સ્વાસ્થ્યની કચેરી

બ્લોક- આઈ, ૭ મો માળ, કુબેર ભવન, કોઠી કચેરી કમ્પાઉન્ડ,

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BY.R.P.A.D

ક્રમાંક:સં.નિ.ઓ.સ.સ્વા./વડો/૧૨૭૫/૨૦૨૩

તારીખ: ૧૩-૦૪-૨૦૨૩

પ્રતિ

કાર્યપાલક ઇજનેરશ્રી,

Bridge Project Department,

વડોદરા મ્યુનીસીપલ કોર્પોરેશન,

ખંડેરાવ માર્કેટ બિલ્ડીંગ,

રાજમહલ રોડ, વડોદરા-૩૯૦૨૦૯

વિષય:- મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારીનું નિયમન અને નોકરીની શરતો) અધિનિયમ, ૧૯૯૬ (The BOCW Act, 1996) હેઠળ બાંધકામ કરતી સંસ્થાની નોંધણી કરાવવાની શરત ટેન્ડર/વર્ક ઓર્ડર/L.O.I.માં ઉમેરવા અને સંસ્થાની નોંધણી કરાવવા બાબત.

સાહેબશ્રી,

ઉપરોક્ત વિષય પરત્વે જણાવવાનું કે, કેન્દ્ર સરકાર દ્વારા બાંધકામ શ્રમયોગીઓના સ્વાસ્થ્ય સલામતી અને કલ્યાણના હેતુ માટે “મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારીનું નિયમન અને નોકરીની શરતો) અધિનિયમ, ૧૯૯૬” (The Building and Other Construction Workers' (Regulation of Employment and Condition of Service) Act, 1996) તારીખ ૦૧/૦૩/૧૯૯૬ થી સમગ્ર ભારતમાં અમલમાં છે. તેમજ અમલીકરણ માટે ગુજરાત સરકાર દ્વારા “ગુજરાત મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારીનું નિયમન અને નોકરીની શરતો) નિયમો, ૨૦૦૩” તારીખ ૧૮/૦૮/૨૦૦૩ના જાહેરનામાથી પ્રસિધ્ધ કરવામાં આવેલ છે.

મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારીનું નિયમન અને નોકરીની શરતો) અધિનિયમ, ૧૯૯૬ ની કલમ-૪૨(૩) અન્વયે ગુજરાત રાજ્યમાં કાયદાના અમલીકરણ માટે ઇન્સ્પેક્ટર ઓફ ઇન્સ્પેકશન ઓફ બિલ્ડીંગ એન્ડ અધર કન્સ્ટ્રક્શન, વર્ગ-૨ની નિમણૂક કરવામાં આવેલ છે.

ઉક્ત અધિનિયમ (The BOCW Act, 1996)ની કલમ-૭ તેમજ તે હેઠળના ગુજરાતના નિયમ-૨૩ મુજબ દરેક સંસ્થાના માલિકે કામકાજ શરૂ કર્યાનાં ૬૦ દિવસમાં બાંધકામ સાઇટની સંસ્થાની નોંધણી www.lfp.gujarat.gov.in પર જરૂરી નિયત દસ્તાવેજો સાથે ઓનલાઇન ફીની ચૂકવણી કરી કરવાની રહે છે. સદર અધિનિયમની કલમ-૧૦(એ) મુજબ કલમ-૭ હેઠળની નોંધણીપાત્ર સંસ્થાના માલિક દ્વારા સંસ્થાની નોંધણી કરાવ્યા વિના બાંધકામ શ્રમિકોને બાંધકામ સાઇટ પર કામે રાખી શકાય નહીં અને આ અંગે કસુર કરવામાં આવે તો બાંધકામ સંસ્થા/માલિક/કોન્ટ્રાક્ટર વિરુદ્ધ કાયદેસરની કાર્યવાહી હાથ ધરવાની રહે છે.

ગુજરાત સરકારશ્રી દ્વારા બાંધકામ સાઇટ પર બનતા અકસ્માતોની સંખ્યા ઘટાડવાના અભિગમના ભાગરૂપે ઉક્ત અધિનિયમ હેઠળનાં ઇન્સ્પેક્ટર ઓફ ઇન્સ્પેકશન ઓફ બિલ્ડીંગ એન્ડ અધર કન્સ્ટ્રક્શન, વર્ગ-૨ ની વિવિધ બાંધકામ સાઇટો પર કામ કરતા બાંધકામ શ્રમિકોની સુરક્ષા, સ્વાસ્થ્ય અને

કલ્યાણલક્ષી જોગવાઈઓ અન્વયે તપાસ કરવાની જવાબદારી હોઇ આપના ટેન્ડર/વર્ક ઓર્ડર/L.O.I.માં નીચે મુજબની શરતનો ઉમેરો કરવામાં આવે તેમજ સંસ્થા દ્વારા નોંધણી કરાવવામાં આવે તો કાયદાનું અમલીકરણ વધુ સારી રીતે થઈ શકે તેમ છે.

“દરેક બાંધકામ સંસ્થાના માલિકે/કોન્ટ્રાક્ટરે બાંધકામ પ્રવૃત્તિ શરૂ કર્યાનાં ૬૦ દિવસમાં મકાન અને અન્ય બાંધકામ શ્રમયોગીઓ (રોજગારીનું નિયમન અને નોકરીની શરતો) અધિનિયમ, ૧૯૯૬” (The BOCW Act, 1996) અને તે હેઠળના ગુજરાતના નિયમો, ૨૦૦૩ અન્વયે સંસ્થાની નોંધણી સંયુક્ત નિયામકશ્રી, ઔદ્યોગિક સલામતી અને સ્વાસ્થ્યની કચેરી, વડોદરા ખાતે કરાવી નોંધણી પ્રમાણપત્રની નકલ અત્રે રજૂ કરવાની રહેશે તેમજ ઉક્ત કાયદા અને નિયમો હેઠળ બાંધકામ સાઈટ પર સલામતીના નિયમોનું પાલન કરવાનું રહેશે.”

ઉક્ત હકીકતને ધ્યાને લઈ આપના હસ્તકની હાલમાં કાર્યરત બાંધકામ સાઈટ પર બાંધકામની કામગીરી અર્થે રોકેલ સંસ્થાની નોંધણી કરાવવા અર્થે દરેક માલિક/કોન્ટ્રાક્ટર ને The BOCW Act, 1996 હેઠળ સંસ્થાની નોંધણી કરાવી પ્રમાણપત્રની નકલ ફરજિયાત માંગવામાં આવે તે મુજબની કાર્યવાહી થવા વિનંતી છે.

U.S. Patel
(વાર્ચ.એસ.પટેલ)

ઇન્સ્પેક્ટર ઓફ ઇન્સ્પેકશન ઓફ
બિલ્ડીંગ એન્ડ અધર કન્સ્ટ્રક્શન, વર્ગ-૨
વડોદરા

વડોદરા મહાનગર પાલિકાનાં વિવિધ કામોનાં
ભાવપત્રોના મૂલ્યાંકન કરવા બાબત.

વડોદરા મહાનગર પાલિકા
સીટી એન્જીનીયરશ્રીની કચેરી
પરિપત્ર અંક: ૦૧/૨૦૨૪-૨૫
તા.૧૨-૦૭-૨૦૨૪.

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OUTWARD NO: ૩૦૭
DATE: 12-07-2024

વંચાણે લીધા:૧)ગુજરાત સરકારશ્રી,માર્ગ અને મકાન વિભાગનો પરિપત્ર ક્રમાંક:-

ટી.એન.સી./૧૦/૨૦૧૩/-૩(ભાગ-૦૧)-સ.તા.૧૯-૧૧-૨૦૧૩.

૨)ગુજરાત સરકારશ્રી,માર્ગ અને મકાન વિભાગનો પરિપત્ર ક્રમાંક:ટી.એન.સી./
૧૦૮૭/૨૫૦/૩-સિ/તા.૨૧-૧૨-૧૯૮૭.

૩)ગુજરાત સરકારશ્રી,માર્ગ અને મકાન વિભાગનો પત્ર ક્રમાંક:RBD/OAS
/e-file/16/2022/0002/C/તા.૧૨-૧૦-૨૦૨૩.

૪) નિરીક્ષકશ્રી રથાનીક ભંડોળ હિસાબ ગુજરાત રાજ્ય ગાંધીનગર અને
મ્યુનીસીપલ કમિશનરશ્રીનાં ચર્ચા પત્ર તા.૨૩-૦૨-૨૪.

વડોદરા મહાનગરપાલિકા દ્વારા વડોદરા શહેરમાં સર્વાંગી વિકાસના વિવિધ ઈજનેરી
કામો કરવામાં આવે છે. કેટલીક કામગીરી વાર્ષિક ઈજારા (ARC) હેઠળ કરાવવામાં આવે છે.
ગુજરાત સરકારશ્રીના માર્ગ અને મકાન વિભાગ, સિંચાઈ વિભાગ, G.W.S.S.B. અને કેન્દ્ર
સરકાર દ્વારા વખતોવખત પ્રસિદ્ધ થતા Schedule of Rate (S.O.R.) મુજબના જ અંદાજો
તૈયાર કરવાના રહે છે. સમયાંતરે ગુજરાત સરકારશ્રીના માર્ગ અને મકાન વિભાગ દ્વારા સંદર્ભ
હેઠળના પરિપત્રો કરેલ છે.

વડોદરા શહેરની જનતાને સમયસર અને ગુણવત્તાયુક્ત સુવિધાઓ ઉપલબ્ધ કરાવવી
જરૂરી છે. આ માટે વખતોવખત સરકારશ્રી દ્વારા અને વડોદરા મહાનગરપાલિકા દ્વારા
વિકાસના વિવિધ કામો માટેની ટેન્ડર પ્રક્રિયા હાલ સરકારશ્રી નાં માર્ગ અને મકાન વિભાગની
વિવિધ જોગવાઈઓને ધ્યાને રાખીને ઉચિત વહીવટી પ્રક્રિયા અનુસરીને કામગીરી હાથ ધરવી
જરૂરી છે. વડોદરા મહાનગરપાલિકાના વિવિધ વિભાગો તરફથી ભાવપત્રનું મૂલ્યાંકન કરતા
સમયે ખાસ અને ઊંડાણ પૂર્વક ચકાસણી કરીને જ ભાવપત્રો મંજૂરીની કાર્યવાહી અનુસરીને
જ, ટેન્ડર કમિટી કે સક્ષમ મંજૂર કરનાર ઓથોરીટી સમક્ષ દરખાસ્તો રજુ કરવી આવશ્યક
જણાયેલ છે.

વડોદરા મહાનગરપાલિકા દ્વારા બહાર પાડવામાં આવતા વિવિધ ટેન્ડરો માં
ઈજારદારશ્રીઓ દ્વારા ભરવામાં આવતા ભાવો, અદાજીત રકમથી ઘણા ઓછા(નીચા)
ભરવામાં આવે છે અને ઓછા ભાવો-નીચા ભાવો ભર્યા બાદ ઈજારદારો દ્વારા કામની ગુણવત્તા
જાળવી રાખવામાં આવે તે પણ અત્યંત જરૂરી છે. ખાસ કરીને એસાધારણ સ્થાનો(નીચા)
ભાવો ભરવાના પ્રસંગોએ ભવિષ્યમાં પણ ગુણવત્તાલક્ષી પ્રશ્નો આવે તેવી પરિસ્થિતિ ઉભી ન
શાય અને તંદુરસ્ત ટેન્ડરો સ્વીકારવા એ યોગ્ય જણાય છે.

ઇજનેરશ્રી (તમામ કચેરીનાં વડા) અને તમામ કાર્યપાલક ઇજનેરશ્રીઓ (તમામ વિભાગીય વડા) ને જે કામોના ટેન્ડરો અંદાજી રકમ કરતાં ૧૦ ટકા અથવા તેનાથી વધુ ઓછા ભાવના આંવે ત્યારે રેટ એનાલીસીસ દ્વારા ભાવોની વર્કેબિલીટી ચકાસવી અને પોષણક્ષમ ભાવ કરતા પણ નીચા ભાવો લાગતા હોય તો સૌથી ઓછા ભાવો ભરનાર સબંધિત ઇજારદાર કામ પૂરૂ પાડવા શક્તિમાન થશે કે કેમ તેની સંપૂર્ણ વિગતે ચકાસણી કરવાની રહેશે. આવાં ઇજારદારોએ અગાઉ કરેલ કામો તથા હાથ ઉપરના કામોની પ્રગતિ-સમયસર કામગીરી ન કરતા હોય વિગેરે ધ્યાને લઈ આવાં ઇજારદારોની કામગીરી સંતોષજનક જણાય તો જ અસાધારણ ઓછા(નીચા)ભાવના ટેન્ડરો સ્વીકારવા-મંજૂર કરવા ભલામણ કરવાની રહેશે. ઉપરોક્ત સમીક્ષા કરતી વખતે શિફ્ટ્યુલ ઓફ રેટમાં જણાવેલ ભાવો તે વ્યાજબી ભાવ કરતા ઊંચા નથી તેની પણ ખાસ ચકાસણી કરવી જોઈએ.

અસાધારણ નીચા આવતા ભાવપત્રો અંગે તાજેતરમાં રાજ્ય સરકારશ્રીના માર્ગ અને મકાન વિભાગ દ્વારા કરેલ જોગવાઈ S.B.D. મુજબ વધારાની પરફોર્મન્સ સિક્યુરિટી લેવાની રહેશે. વધારાની પરફોર્મન્સ સિક્યુરિટીની જોગવાઈઓ નીચે પ્રમાણે નિર્દિષ્ટ કરેલ છે.

Within 10 (Ten) days of receipt of Letter of Acceptance of Bid or Work order, the successful Bidder shall furnish an irrevocable and unconditional guarantee- "Performance Security" or "Performance Guarantee - bond" for an amount equal to 5% (five percent) of its Contract Price. In case of bids mentioned below, the successful Bidder, along with the Performance Security already mentioned in the tender, shall also furnish to the Authority an irrevocable and unconditional guarantee towards an "Additional Performance Security" or "Additional Performance Guarantee - bond" for an amount calculated as under:

- If the Contract Price offered by the Selected Bidder is lower than 10% but up to 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 20% of the difference in the (i) Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the selected Bidder.
- If the Contract Price offered by the Selected Bidder is lower than 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 30% of the difference in the (i) Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the selected Bidder.
- This Additional Performance Security shall be treated as part of the Performance Security.

સદરજો અમલ તાત્કાલિક અસરથી કરવાનો રહેશે.


12.07.24
સીટી એન્જિનિયર
વડોદરા મહાનગરપાલિકા

નકલ રવાના:

૧. માન.મ્યુનિસિપલ કમિશનરશ્રી તરફ જાણ સારૂ
૨. ડે.મ્યુનિસિપલ કમિશનરશ્રી(૫) તરફ જાણ સારૂ.

ગુજરાત સરકારશ્રી દ્વારા પ્રસિધ્ધ કરેલ Standard
Bidding Document (SBD) નાં કલોઝ નંબર:
24-(iv), 34 અને 52 માં થયેલ સુધારાનો અમલ
કરવા બાબત.

વડોદરા મહાનગર પાલિકા,
સીટી એન્જીનીયરશ્રીની કચેરી,
પરિપત્ર અંક: ૨ / ૨૦૨૬-૨૭,
તા.૧૫-૦૬-૨૦૨૬.

OFFICE OF CITY ENGINEER
OUTWARD NO: ૮૦
DATE: ૧૫/૦૬/૨૬

- સંદર્ભ -1)મ્યુનીસીપલ કમિશનરશ્રીની કચેરીનો પરિપત્ર અંક : ૧૮/ તા.૧૧-૦૯-૨૦૨૪.
2) GUDM નો પત્ર ક્રમાંક : 0248/05/2026/Dt. 26-05-2026.
3) માર્ગ અને મકાન વિભાગ, ગુજરાત સરકાર, સચિવાલયનો ઠરાવ ક્રમાંક:
TNC/102022/458/C/Approved Date: 29-03-2022. & 30-04-2022.
4) માર્ગ અને મકાન વિભાગ, ગુજરાત સરકાર, Block No.14/2, સચિવાલય,
ગાંધીનગરનો ઠરાવ ક્રમાંક : TNC/102022/458/C/E-file No: RBD/OAS/
e-file/16/2022/0002/Section C/ Approved Date:04-05-2026.

વડોદરા મહાનગર પાલિકાની હદ વિસ્તારમાં વિકાસના તથા નિભાવણીના કામો માટે વિવિધ પ્રોજેક્ટ વિભાગ તેમજ ઝોન/વોર્ડ કક્ષાએ શહેરીજનોની સુખાકારી માટેના આંતર માળખાકીય તેમજ અન્ય આવશ્યક કામગીરીઓ, નિભાવણીની કામગીરીઓ માટે ભાવપત્રકો મંગાવી સમયાંતરે સરકારશ્રી તરફથી પ્રસિધ્ધ થતાં પરિપત્રો મુજબ કામગીરી કરવામાં આવે છે.

ગુજરાત સરકારશ્રીના જુદા જુદા વિભાગો, કોર્પોરેશનો, નિગમો વિગેરે દ્વારા પ્રસિધ્ધ કરવામાં આવતાં ટેન્ડરોમાંની વિસંગતતા દુર કરવા તથા એક સમાન ધોરણો અનુસરાય અને એકસુત્રતા જળવાય તે મુજબના ટેન્ડર નાં ધારાધોરણો ની જરૂરિયાત અનુસરે ગુજરાત સરકારશ્રીના માર્ગ અને મકાન વિભાગ દ્વારા તા.૦૧.૧૧.૨૦૨૩ થી Standard Bidding Document (SBD) (સ્ટાન્ડર્ડ બીડીંગ ડોક્યુમેન્ટ) નો અમલ કરવામાં આવેલ છે. ગુજરાત સરકારશ્રીનાં માર્ગ અને મકાન વિભાગ દ્વારા અમલીકરણ કરવામાં આવેલ સ્ટાન્ડર્ડ બીડીંગ ડોક્યુમેન્ટનો વડોદરા મહાનગરપાલિકા દ્વારા સંદર્ભ-૧ થી અમલ કરવામાં આવેલ છે. ગુજરાત કોન્ટ્રાક્ટર એસોસીએશન દ્વારા કરવામાં આવેલ રજુઆતોને ધ્યાને લઈ ગુજરાત સરકારશ્રી તરફથી સંદર્ભ-૪ મુજબ Standard Bidding Document (SBD) ની પ્રવર્તમાન જોગવાઈઓમાં Performance Security, Securities અને Adjustments of bitumen component ને લગત સુધારો કરવામાં આવેલ છે. જેની વિગતો નીચે મુજબ છે.

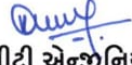
Existing Provisions	Revised Provisions
Section 1: Instructions to Bidders	
34. Performance Security	34. Performance Security
<p>34.1(B) The Performance Security shall be valid beyond 60(sixty) days of the Defects Liability Period and the Additional Performance Security shall be valid beyond 28 (twenty-eight) days of Project Completion Date.</p>	<p>34.1 (B) The Performance Security shall be valid beyond 60 (Sixty) days from the stipulated date of completion of the project and the Additional Performance Security shall be valid beyond 28 (twenty-eight) days of Project Completion Date.</p> <p>Performance Security shall become refundable/releasable within 15 days after certified project completion date subject to Fulfillment of contractual obligation and settlement of all dues and claims.</p>
Section 3: CONDITIONS OF CONTRACT	
52. Securities	52. Securities
<p>52.1 The performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and Denominated in Indian Rupees. The performance Security shall be valid until a date 60 days from the certified date of completion of the project and the additional security.</p>	<p>52.1 The performance Security (including Additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The performance Security shall be valid until a date 60 days from the certified date of completion of the project and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion of the work.</p> <p>Performance and Additional Performance Security shall become refundable/releasable within 15 days after project certified completion date subject to fulfillment of contractual obligation and settlement of all dues and claims.</p>
Section 4: Contract Data	
24(iv): Adjustment of bitumen component	24(iv): Adjustment of bitumen component
<p>Bi = The official retail price of bitumen of IOC depot at the nearest center for the 15th day of the month under consideration.</p>	<p>Bi : The official price of bitumen of IOC depot at the nearest center: For the first 15 days of the month under</p>

	consideration, the price declared on the 1 st day of that month. For the remaining days of the month under consideration, the rate declared on the 16 th day of that month.
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Standard Bidding Document (SBD) ની જોગવાઈઓમાં ઉક્ત સુધારા સિવાયની અન્ય તમામ જોગવાઈઓ યથાવત રહેશે.

ગુજરાત સરકારશ્રી , માર્ગ અને મકાન વિભાગ નો ઠરાવ ક્રમાંક : TNC/102022/458/C/E-file
No: RBD/OAS/e-file/16/2022/0002/Section-C/Approved Date:04-05-2026 ની નકલ આ સાથે સામેલ કરેલ છે.

સદરનો અમલ તાત્કાલિક અસરથી કરવાનો રહેશે.


સીટી એન્જીનિયર
વડોદરા મહાનગરપાલિકા

નકલ રવાના:

૧. મ્યુનિસિપલ કમિશ્નરશ્રી તરફ જાણ સારું.
૨. ડે.મ્યુનિસિપલ કમિશ્નરશ્રી(વ) તરફ જાણ સારું.
૩. ડે.મ્યુનિસિપલ કમિશ્નરશ્રી(પ્રોજેક્ટ) તરફ જાણ સારું.
૪. એડી. સીટી એન્જીનીયરશ્રી (પાણી પુરવઠા પ્રોજેક્ટ/ વિતરણ/ ઇલે.મીકે/ સુવેઝ-ડી-વર્ક્સ/ ડ્રેનેજ પ્રોજેક્ટ/ વરસાદી ગટર પ્રોજેક્ટ/ વિશ્વામિત્રી પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું.
૫. કાર્યપાલક ઇજનેરશ્રી (રોડ પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું.
૬. કાર્યપાલક ઇજનેરશ્રી (બ્રીજ પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું.
૭. કાર્યપાલક ઇજનેરશ્રી (ટ્રાફિક) તરફ જાણ તથા અમલ સારું.
૮. કાર્યપાલક ઇજનેરશ્રી (ફ્યુચરીસ્ટીક પ્લાનિંગ સેલ) તરફ જાણ તથા અમલ સારું.
૯. કાર્યપાલક ઇજનેરશ્રી (ડ્રેનેજ પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું.
૧૦. કાર્યપાલક ઇજનેરશ્રી (વરસાદી ગટર પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું
૧૧. કાર્યપાલક ઇજનેરશ્રી (સ્ટ્રીટ લાઇટ) તરફ જાણ તથા અમલ સારું.
૧૨. કાર્યપાલક ઇજનેરશ્રી (એફોર્ડેબલ હાઉસિંગ સેલ) તરફ જાણ તથા અમલ સારું.
૧૩. કાર્યપાલક ઇજનેરશ્રી (પાણી પુરવઠા પ્રોજેક્ટ) તરફ જાણ તથા અમલ સારું.

કામનું નામ :- ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (યુનિટ રેટ)

વડોદરા મ્યુનિસિપલ કોર્પોરેશન

શાખા - ટ્રાફિક શાખા

પરસેન્ટેજ રેટ ભાવપત્ર

ભાવપત્ર ભરનારનું નામ: હું

/અમે લખેલ કામ આંકડામાં

ટકા શબ્દોમાં

અંદાજપત્રકમાં દાખલ કરેલા ભાવ કરતાં ઓછા / વધુ ભાવ ભરવા ખુશી છુ/છીએ.

કામનું વર્ણન

કામનો અનુ. ક્રમ નંબર	કામનું નામ	અંદાજપત્રકની રકમ દેખરેખ આકાર તથા અણધાર્યા ખર્ચની રકમ સિવાય	કામ પુરુ કરવાની મુદત	નોટો રોકડ ઇત્યાદી રકમ બાનાની ભરેલી અનામત તરીકે તેની તપસીલ રકમ
૧	ટ્રાફિક શાખા માટે વાર્ષિક ઈજારાથી શહેરના વિવિધ વિસ્તારમાં હોટ એપ્લાઈડ થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાનું તેમજ વિવિધ રોડ ફર્નિચર લગાવવાનું કામ. (યુનિટ રેટ) ટેન્ડર ફી-રૂ.૨૦,૦૦૦/- સ્ટેમ ડ્યુટી :-રૂ.૩૦૦/-	રૂ.૫.૦૦ કરોડ ની મર્યાદામાં	૧ વર્ષ	૨% અનામત પેટે રૂ. ૧૦,૦૦,૦૦૦/- નો નેશનલાઈઝ બેન્ક/ ઉપર જણાવેલ લિસ્ટ મુજબની બેંકના ડીમાન્ડ ડ્રાફ્ટ/બેંક ગેરંટી રજુ કરવાનો રહેશે.

જો સદરહુ ભાવપત્ર સ્વીકારવામા આવે તો હું/અમો ઉપરોક્ત તથા સામેલ રાખેલી કરારની તમામ શરતો પ્રમાણુ વર્તવા બંધાઉ છુ /છીએ અને તે પ્રમાણે વર્તવામાં ચુકીએ તો શીક્ષા તરીકે કરારમાં જણાવેલી રકમ અગર દંડ વડોદરા મ્યુનિસિપલ કોર્પોરેશનમાં ભરીશું આ સાથે અનામત રૂ.૧૦,૦૦,૦૦૦/- રકમ મોકલી છે તે રકમ હું/અમો અંદાજની રકમ ઉપર ૫ ટકા અનામત ન ભરીએ તો મારી માંગણી મંજુર થયે સોબતના કરારની કલમ-૧ પ્રમાણે મ્યુનિસિપલ કોર્પોરેશન કરી પાકે ખાતે જમા કરે તે મને /અમોને કબુલ મંજુર છે.

તા. / / ૨૦૨૬.

ભાવપત્ર ભરનારની સહી.....

સરનામું.....

સદરહુ ભાવપત્રક વડોદરા મ્યુનિસિપલ કોર્પોરેશન વતી મંજુર.

તા. - -૨૦૨૬

મંજૂર કરનાર અધિકારીની સહી

કરારની શરતો

- ૧) જે ઇજારદારનું ભાવપત્રક મંજૂર કરવામાં આવ્યું હોય તેણે ભાવપત્ર મંજૂર કર્યાની ખબર આપ્યાની તારીખથી એક અઠવાડિયાના મુદતમાં જો મહાનગરપાલિકાને જરૂર લાગેતો આ શરતો પર યોગ્ય રેટેમ્પ લગાડી સહી કરી આપવી જોઈએ અને તે કરાર તરીકે ગણાશે તેમજ તેની કરારની શરતો પુરેપુરી પાળવાની જામીનગીરી તરીકે રોકડ રકમ કામની અંદાજિત કિંમત કે મંજૂર ભાવપત્રક ની રકમ બે માંથી જે વધુ હોય તે રકમના પાંચ ટકા સુધીની (બાના તરીકે આવેલા બે ટકા સાથે) અનામત ભરી દેવી જોઈએ અગર કામના ચાલુ દેવાયાદીઓ (બીલો) માંથી દસ ટકા રકમ કાપી અનામત આપવી પડશે. ઉપર દર્શાવેલી મુદતમાં આ પ્રમાણે કરવામાં નહીં આવે તો ભાવપત્ર સાથે રજુ કરેલી બે ટકાની અનામત જસ થવાને પાત્ર થશે તેમજ ઇજારદારને રજીસ્ટ્રેશન નામોની ચાલીમાંથી સદરહું ઇજારદારનું નામ કમી થવાને પાત્ર થશે.
- ૨) ભાવપત્રમાં કામ પુરૂ કરવાની દર્શાવેલી મુદતમાં ઇજારદારે ચોકકસપણે કામ પુરૂ કરવું જોઈએ અને ઠરેલી મુદતમાં કામ પુરૂ કરવાની ઠરેલી તારીખ પછી જેટલો સમય વધુ થાય તેટલા સમયના પ્રતિ દિન ૦.૦૫૦% પરંતુ વધુમાં વધુ ૧૦% સુધીનો ભાવપત્રની રકમનો દંડ (લીકવીડીટી કેમેજ તરીકે) વર્કઓર્ડર આપ્યા તારીખના દિન-૭ થી ગણવામાં આવશે.
- ૨) (૧) ભાવપત્રમાં જણાવેલું કામ શરૂ કર્યાનું જે તે તારીખથી ઇજારદારે દિન-૪માં લેખી જાહેર કરવું પડશે. તે પ્રમાણે નહીં થયેલાનું જણાયે થી નીચે મુજબ દંડ લેવામાં આવશે. (તા ૧-૪-૧૪ થી અમલમાં) મંજૂર થયેલ દરો નીચે પ્રમાણે છે.
- ૧ થી ૭ દિવસ - રૂ. ૧૦૦૦/-
૮ થી ૧૫ દિવસ - રૂ. ૧૫૦૦/-
૧૬ થી ૩૦ દિવસ - રૂ. ૨૦૦૦/-
૩૦ દિવસ થી વધુ માટે ૫૦૦૦/-
- કરારની શરત નં ૩ ની પ્રથમ લીટીમાં વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારીને શબ્દોના બદલે સંબંધકર્તા બાંધકામ શાખાના અધિકારીને જેમને હવે પછી બાંધકામ અધિકારીને કહેવાશે.
- ૩) ચાલુ કામમાં જો વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારીને એમ લાગે કે ઇજારદાર નિર્ણયક કામ લંબાવ્યા કરે છે. અગર તે ઠરેલી મુદતમાં અથવા જે પ્રમાણે કામ નહીં કરી શકે એવો સંભવ છે. તો ખાતાનો કરાર રદ કરવાનો અગર કરારદારને સુચના આપ્યા સિવાય કરારદારને ખર્ચ અને જોખમ મહાનગરપાલિકાના હિત અને સગવડની દ્રિષ્ટિએ કામ પુરૂ કરાવી લેવાનો અધિકાર રહેશે. અને કરારદારને સદર હું કામ અંગે સ્થળ પર માલસામાન એકત્ર કર્યો હોય અગર બીજા કોઈ જાતની જવાબદારી માથે લીધી હોય તેમાંથી ઉત્પન્ન થતી ખોટ માટેનું નુકશાની માંગવાનો હક રહેશે નહીં અને આવા પ્રસંગે એટલે કામ બીજી રીતે પુરૂ કરવાનું હોય ત્યારે મહાનગરપાલિકાને કામ પુરૂ કરતા જે વિશેષ ખર્ચ થાય તેમાથી કાપી લેવાની વડોદરા મહાનગરપાલિકાને ના બાંધકામ અધિકારીને સત્તા રહેશે અને દર્શાવ્યા પ્રમાણે કરાર રદ કરવામાં આવે તે પ્રસંગે વડોદરા મહાનગરપાલિકાને ના બાંધકામ અધિકારીથી કેટલું અને કેટલી કિંમતનું કામ થયું છે. તે સંબંધી પ્રમાણપત્ર ન આપે ત્યાં સુધી કરારદારને કોઈ રકમ વસુલ કરવાનો હક રહેશે નહીં. અગર તે સંબંધી નાણા અદા કરવામાં આવશે નહીં અને જયારે કરેલા કામની કિંમત આપવામાં આવે ત્યારે મહાનગરપાલિકાના બાંધકામ અધિકારી એ આપેલા પ્રમાણપત્રમાં દર્શાવેલી રકમ અદા થવાને પાત્ર થશે.
- ૪) ઉપર કોલમમાં દર્શાવેલો અધિકાર આપવાના પ્રસંગે વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારીને જરૂર લાગે તો કામ કરવાના સ્થળે અગર તેની આજુબાજુની જમીન પર પડેલો માલસામાન હથિયાર વિગેરે પુરેપુરો અગર અશંત ખોતાને કબજે લઈ કરારમાં કરારમાં દર્શાવેલ ભાવ મુજબ અગર તેના ભાવે ચાલુ બજાર ભાવ પ્રમાણે તેના નાણા અદા કરી શકશે. અગર હિસાબમાં મજરે આપી શકશે તે પ્રમાણે જરૂર ન લાગે તો ઇજારદારે આપો માલસામાન હથિયાર વિગેરે સ્થળ પર થી ખસેડવા જોઈએ અને તે પ્રમાણે ખસેડવામાં ન આવે તો બાંધકામ અધિકારી ઇજારદારના ખર્ચે ખસેડી શકાશે. અગર હરાજ થી તેનું વેચાણ કરી તેનું ઉત્પન્ન ઇજારદારને મજરે આપશે અથવા બાંધકામ અધિકારી આપો

માલસામનનો તેનો કોઈ ભાગનો અગર જામીનગીરીનો અગર અનામત રાખેલા પૈસાનો અગર ઇજારદારને અદાપાત્ર થયેલી અગર થનારી કોઈ રકમનો પુરેપુરો અગર જરૂર લાગે તેટલો ઉપયોગ ઇજારદારને કરેલા ખરાબ અથવા મનરવી રીતે કરેલા કામને સુધારવા ખોતાને યોગ્ય લાગે એવી રીતે કરી શકશે.

૫) ઇજારદારને આલુ કામમાં એવી હરકત બદે કે કામ પુરૂ કરવામાં વિશેષ સમયની અપેક્ષા રહે તો હરકતની તારીખથી એક માસની મુદતમાં તેણે બાંધકામ અધિકારી તરફ અરજી કરવી જોઈએ અને તેમણે સબબ કારણો લાગે તો યોગ્ય વધુ મુદત આપી શકશે. પરંતુ આ પ્રમાણેની બાંધકામ અધિકારી તરફથી મળેલી લેખિત હુકમ સિવાય ઇજારદારના કસરતની શરતોની કલમ -૨ મુજબ જો ઠરેલી મુદતમાં પુરૂ ન થાય તો વધુ મુદત માટે દંડ ને પાત્ર થતી રકમ ભરવાના જવાબદારીમાંથી મુક્ત થઈ શકશે નહીં.

૬) જ્યાં ઇજારદારે પાલખ, વધારાનો કચરો તેમજ છાર તેમજ વિગેરે દૂર કર્યા ન હોય તેમજ મકાનને દુરસ્તી કરવાનું કામ અગર એવું બીજું કામ સુખત કર્યું હોય તેમા લાકડા કામ બારણાઓ બારીઓ, દિવાલ, માલના નળિયાની ફરસબંધના અગર મકાનના કોઈ પણ ભાગ પર કાઠકુદ સાફ કરે નહીં ત્યાંસુધી કોઈ પણ કામ પુરૂ થયું છે. એવું માની શકશે નહીં. જો ઇજારદારને ખર્ચે પ્રમાણેકામ પુરૂ કરી સુખત કરતા ઓખુ કરવામાં કસુર કરશે તો બાંધકામ અધિકારી ઇજારદારને ખર્ચે આ પ્રમાણે કસવી શકશે.

૭) રૂ.૫૦૦/- રૂપિયા પાંચસો સુધીના કામના ખર્ચની રકમ કામો પુરા થઈ પસંદ થયા સિવાય અદા થઈ શકશે નહીં. અને રૂ.૫૦૦/- રૂપિયા પાંચસો થી અધિક અંદાજવાળા કામોમાં કામ પુરતા તેમજ ઇજારદારને ખાતાને જે અમલદારની સુખતમાં કામ હશે તેવા અમલદારે આપેલા માપ મુજબ માસીક દેવાયાદી બનાવી રકમ આ થઈ શકશે. પરંતુ આવી આલુ કામમાં અદા થયેલ રકમો કામ ખરેખરી રીતે પુરૂ થયું એ હિસાબે આપવામાં આવી છે તે પ્રમાણે ન ગણતા માત્ર છેવટ હિસાબની શરતે આ થઈ છે. (Payment on Account) એ પ્રમાણે ગણવામાં આવશે અને છેવટની દેવાયાદી આકારમાં તેનો સમવેશ કરવામાં આવશે.

૮) કોઈ પણ કામના નાણાં તે કામ સંપૂર્ણ રીતે સાડ અને વર્ણન પ્રમાણે હોયા વગર અદા કરવામાં આવશે નહીં. એ કદાચ શરતચુકથી ખરાબ કામ પસંદ કરવામાં આવી નાણાં આપવામાં આવેલ હોય તો તેને ભવિષ્યમાં કોઈ પણ હિસાબમાંથી બાતલ કરી તેના આ થયેલા નાણાં છેવટનો દાખલો આપતી વખતે અગર તે પહેલા કોઈ પણ વખતે વસુલ કરવા હુકમ કરવા બાંધકામ અધિકારીને સંપૂર્ણ અધિકાર છે.

૯) જ્યારે કોઈ પણ અંદાજપત્રમાં અગર શરત પત્રમાં (સ્પેશીફિકેશનમાં) વડોદરા મહાનગરપાલિકાની વખાતમાંથી અમુક જાતનો માલસામાન આપવામાં આવશે. અગર ઇજારદારે વડોદરા મહાનગરપાલિકા તરફથી આપવામાં આવનાર માલસામાન વાપરવો જોઈએ એવું ઠરેલું હોય ત્યારે તે અંદાજપત્ર સાથે આપવામાં આવનાર માલસામાનના તપસીલનો ભાવ તથા આપવાનો જગો વિગેરેની વિગત સહનું પત્ર સામેલ રાખવું જોઈએ અને ઇજારદારને વખતો વખત જરૂર પ્રમાણે માલ આપવો જોઈએ. અને એકંદરે આપેલા માલની કિંમતના નાણા ઇજારદારે અદા થવાના નાણાંની દેવાયાદીમાંથી અગર લહેણાંમાંથી અંદાજપત્રમાંથી દર્શાવેલ દરને પ્રમાણે અગર અંદાજપત્રના અભાવે ઇજારદારે સહી કરેલા પત્રકમાંના દરને ધોરણે વસુલ લેવામાં આવશે. ઇજારદારને આપવામાં આવેલ તમામ માલસામાન મહાનગરપાલિકાની મિલકતમાં ગણવામાં આવશે. અને તે કોઈ પણ કારણે કામ ઉપરથી લઈ જઈ શકશે નહીં. તેમજ મહાનગરપાલિકાના બાંધકામ અધિકારી ગમે તે વખતે તપાસી શકશે. આવી રીતે આપેલા માલસામાન પૈકી કામ પુરૂ થયે અગર ઇજારો રદ કરવાનાં પ્રસંગે જે કઈમાં માલસામાન વધે તે બાંધકામ અધિકારી જરૂર જણાય વખાતમાં પાછો લેવામાં ઇતર પ્રસંગે વધેલો સામાન ઇજારદાર પરત કરી શકશે નહીં અગર તેના અંગે કોઈ પણ જાતની નુકશાની માંગી શકશે નહીં.

૯/૧) મહાનગરપાલિકા તરફથી ઇજારાથી આપવામાં આવતાં કામો કરવા જો કોઈ પણ પ્રકારનો માલસામાન કોન્ટ્રાક્ટરને આપવામાં આવે તે તમામ માલસામાન ની બદલીની સહી તેઓ અગર તેઓ નીમે તે પ્રતિનિધીએ રજીસ્ટરમાં કરી આપવાની રહેશે. (રે.દ.નં ૮૦૭/તા.૨૯.૧૧.૧૯૭૩)

૯/૨) સદર હું માલસામાન સાચવવાની તેમજ ગેરઉપયોગ ન થાય તે બાબતની તમામ પ્રકારની જવાબદારી કોન્ટ્રાક્ટરને શીરે રહેશે. માલમાં કોઈ પણ પ્રકારની ઓરી અગર નિષ્કાળજી ના પરિણામે ઘટ આવશે અથવા માલનું નુકશાન થશે તેની

જવાબદારી ડોન્ટાડટર ની છે અને રકમ ડોન્ટાડટરે પોતાના ખર્ચની આપવાની રહેશે તેમજ બીલામાંથી તે કપાત કરી લેવામાં આવશે. (રે.ઈ.નં ૮૦૭/તા.૨૮.૧૧.૧૯૭૩ થી મંજૂર)

૧૦) ઈજારદારે તમામ કામ સંગીન સારી કામગીરીથી કરવું જોઈએ અને શરતપત્રમાં જણાવેલ વર્ણન પ્રમાણે માલસામાન વાપરવો જોઈએ તેમજ ઈજારદારને જાણવા માટે મહાનગરપાલિકા ના બાંધકામ અધિકારીના સહીથી રાખેલા કામને લગતા નકશાઓ, સુચનાઓનો ચુસ્ત રીતે અમલ કરવો જોઈએ.

જ્યારે નકશા, અંદાજ અને સ્પેશીફિકેશનમાં માપો જથ્થાની વિસંગતિ હોય ત્યારે નકશા અંદાજ અને સ્પેશીફિકેશન ના અનુક્રમ પ્રમાણે કામ કરવાનું છે. પરંતુ માપો અને જથ્થામાં ભૂલ થયેલી ના હોય અને વર્ણનની વિસંગતિ હોય તો અંદાજ, નકશા અને સ્પેશીફિકેશનના અનુક્રમ પ્રમાણે કામ કરવાનું છે. તે બાબતની સૌથી ઉત્તમ પ્રથા ધ્યાનમાં રાખીને સુચના આપી અને ઈજારદારે તે પ્રમાણે કામ કરવું જોઈએ. નકશો અને અને સ્પેશીફિકેશનમાં દેખાતી ભુલો ક્ષતિઓ હોય તો કરાર ધ્યેયને લક્ષમાં રાખી બાંધકામ અધિકારી આ ભુલો અને ક્ષતિઓ સુધારી શકશે. નકશા, અંદાજ અને સ્પેશીફિકેશનમાં માપો જથ્થો અને વર્ણનની વિસંગતિ સિવાય ખામીવાળું વર્ણન અને સ્પષ્ટતાઓ માટે સીટી એન્જીનીયરનો નિર્ણય છેવટનો ગણાશે અને ઈજારદારને તેવા પ્રમાણે કરવું પડશે.

૧૧) અંદાજપત્રમાં બતાવેલા માપો ફક્ત અંદાજ હોય તેમાં કામની જરૂરીયાત પ્રમાણે વધઘટ થવાને પાત્ર છે.

૧૨) યોગ્ય અધિકારીના હુકમથી વડોદરા મહાનગરપાલિકા ના બાંધકામ અધિકારીને કામના નકશા મુળ ખતપત્ર સ્પેશીફિકેશન વિગેરેમાં જરૂરી તે ફેરફાર તેમજ સુધારો કરવાનો ચાલુ કામમાં અધિકાર છે. કામની સ્થિતિને અનુસરીએને સુચના વિગેર આપી શકશે. અને આવી રીતે લેખિત આપેલી સુચના પ્રમાણે કામ કરવા ઈજારદાર બંધાયેલા છે. આવા ફેરફારથી મુળ કરાર ૨૬ થયેલ ગણવામાં આવશે નહીં આવી રીતે ભાવપત્રમાં દર્શાવેલા માપના કરતા વધુ કામગીરી અગર નહીં દાખલ કરેલ રકમનું કોઈ પણ કામ (Extra Item) કામના ભાગ તરીકે ઈજારદાર ને સુપ્રત કરવામાં આવે તે કામ તેમણે મુળ કામ માટે મુકરર થયેલી તમામ શરતોને અનુસરીને તથા ભાવપત્રમાં નમુદ કરેલા ભાવથી કરવા પડશે અને કામ પુરૂ કરવાની મુદત વધુ આપેલા કામના મુળ કામ સાથેના પ્રમાણોનુસાર વધારવામાં આવશે અને આ પ્રમાણે માટે બાંધકામ અધિકારી જે દાખલો આપે તે બંધનકર્તા ગણાશે. કરારના બહારની રકમનું વધારાનું કામ પ્રમાણભુત ભાવપત્ર (Schedule Rates) માં દાખલ કરેલા ભાવો પ્રમાણે કરવું પડશે અને તેમાંથી કરાર પ્રમાણે મુળ કામના ભાવ માટે જે ટકા બાદ કરવાના ઠરેલા હોય તેટલા ટકા બાદ કરવામાં આવશે અને આવા પ્રમાણભુત ભાવપત્ર માં ટકા રકમ (Item) દાખલ ન થયેલી હોય તેના ભાવ યોગ્ય અધિકારી તરફથી મંજૂર થાય તે જો ઈજારદાર આથી વધારાની રકમ નું કામ કરવા કબૂલ હોય તે ઈજારદારે સ્વીકારવું જોઈએ. આવા ભાવ ટકાની કપાતોપાત્ર નહીં એવી રીતે નિવળ મંજૂર કરવામાં આવશે અને જો ઈજારદાર પ્રમાણભુત ભાવપત્રોમાં જેનો સમાવેશ કરેલો ન હોય તેનું વધારાનું કામ કરવા ખુશી ન હોય તો મહાનગરપાલિકા બાંધકામ અધિકારી આવા બાંધકામ માટે નિયમ પ્રમાણે યોગ્ય તજવીજ કરી શકશે.

૧૩) શરત પ્રમાણે ઠરેલા કામો પૈકી કોઈના માપ અગર સ્થળની સ્થિતિમાં ફેરફાર કરવાનો પૈકી કોઈના કામ અગર તેનો ભાગ કમી કરવાનો અગર કરારદાર પાસેથી બદલામાં બીજુ આપીને આપ્યા વગર કાઢીને લેવાનો અથવા કોઈ પુરૂ અગર અંશતઃ કરેલું કામ કાઢી નાંખવાનો અગર તેમાં ફેરફાર કરવા મહાનગરપાલિકાના બાંધકામ અધિકારી ને અધિકાર છે. કામનો કોઈ ભાગ કરારદાર પાસે થી કાઢી લેવામાં આવે તે પ્રસંગે તેટલું કામ ન કરવાના અગર કાઢી લેવાના સબકથી કોઈ પણ જાતની નુકશાની માંગી શકશે નહીં.

૧૪) જો વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારી સાહેબે અગર તો તેમના નાયબને કામ બદલ અધુરૂ બીન સફાઈવાળી કામગીરીથી કરેલાનું જણાય અગર હલકી જાતનો માલસામાન વાપરવાનું જોવામાં અગર તો તમામ કામ અગર તેનો ભાગ ઈજારદારને કામની જરૂરીયાત પ્રમાણે દુરસ્ત કરવા કાઢી નાંખવા અગર ફરીથી કરવા લેખી સુચના આપી તે ઉપરથી ઈજારદારે તે પ્રમાણે પોતાના ખર્ચ કરવું જોઈએ. અને આવી રીતે બાંધકામ અધિકારી અગર તેમના નાયબે આપેલી મુદત અંદર જો ઈજારદાર ખર્ચ કરવા ઈન્કાર કરે અગર કામની સ્થળ સીમા ઉપરથી કોઈ પણ જાતનો માલસામાન તથા જણસો જે હલકી ખરાબ (બિન મજબુત તથા ઈજારાની શરતો વિરુદ્ધ) હોય એવી આપેલી મુદત

અંદર દૂર કરવા બાંધકામ અધિકારી પુર્તતા કરી લઈ તેના ખર્ચની રકમ ઇજારદારની કોઈ પણ પ્રકારનીલહેણી રકમો વસુલ કરી શકશે.

- ૧૫) જો વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારી ને થયેલ કામ એકમ શરતપત્ર (Specification) પ્રમાણે થયેલું નથી પરંતુ તે કામ ચાલવા દેવું એવું લાગે તે માટે તેમને યોગ્ય લાગે તે ભાવ કાપી નાણાં અદા કરવા તેમને અધિકાર છે. પણ આવી રીતે કરવું કે ન કરવું તેમની મરજી ઉપર છે.
- ૧૬) ઇજારદારથી આવેલા તમામ ચાલતા કામો વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારી તથા તેમના નાયબો દેખરેખ રાખી તપાસી શકશે. ઇજારદારે હંમેશા જ્યારે કામ પર પોતે હાજર રહી શકે તેમ ન હોય ત્યારે પોતાના જવાબદાર પ્રતિનિધિને કામની વખતે અને જ્યારે બાંધકામ અધિકારી તરફથી અગર તેમના નાયબ અધિકારી તરફથી સુચના મળે તેમની સુચનાઓ તથા હુકમ લેવા દર વખતે હાજર રાખવા જોઈએ અને આવી રીતે રખાયેલા પ્રતિનિધિને જે કાંઈ હુકમો આપવામાં આવે તે ખુદ મુળ કોન્ટ્રાક્ટરને આપવામાં આવેલા હુકમો પ્રમાણે જ બંધનકાર ગણવામાં આવશે.
- ૧૭) વડોદરા મહાનગરપાલિકાના બાંધકામ અધિકારી તરફથી જણાવવામાં આવે તે વખતે કામની તપાસણી અંગે જોઈતા હથિયારો મજુરો વિગેરે તમામ ઇજારદાર તરફથી પોતાના ખર્ચે આપવામાં આવશે અને જો આવી રીતે ઇજારદાર આપવામાં ચુકે તો ઇજારદારના ખર્ચે કરી લેવા અને થયેલો ખર્ચ તેના અદા થવાની નાણાની દેવાયાદીમાંથી વસુલ થઈ શકશે.

~~૧૮) જ્યારે કામનો કોઈ પણ ભાગ હંકાઈ જવાનો હોય અને જો તેના માપ લઈ શકાય એવી સ્થિતિ બહાર જતાં હોય ત્યારે કામ હંકાઈ જતાં પહેલા તેના ખર્ચ માપો લઈ શકાય તે અર્થે આવા કામો હંકાતા પહેલા ઇજારદારે મહાનગરપાલિકાના બાંધકામ અધિકારી અગર તેમના નાયબને બિદાન સાત દિવસની લેખિત સુચના આપવી જોઈએ અને થયેલું ઢાકી તેમની લેખિત પરવાનગી મેળવવી જોઈએ. જો ઉપર પ્રમાણે વર્તન કરવામાં ચુકે તો બાંધકામ અધિકારી ને યોગ્ય લાગે તો ઢાકેલા ભાગ ઇજારદાર ખર્ચે ઉઘડાવી શકશે અગર તેનો ખર્ચ એવા કામ તથા માલસામાન બદલ નાણાં અદા કરવામાં આવશે નહીં.~~

~~૧૯) જો કોઈ ઇજારદાર અગર તેના કામ ઉપરના માણસો જે કામ ઉપર તે કામ કરતા હોય તે કામના કોઈ પણ ભાગમાં અથવા મકાનને રસ્તાને બંધન અગર ઘાસ ઉગેલી જમીનને અગર વાવેતર કરેલી જમીનને તોડે બગાડે અગર નુકશાન પહોંચાડે અગર કામ ચાલુ હોય તે વખતે કોઈ પણ કારણથી તે કામને કઈ નુકશાન પહોંચે અગર તો કામ પુરું થવાની તારીખથી એક વર્ષ ની અંદર ખામી જણાઈ આવે તો તેણે પોતાના ખર્ચે દુરસ્ત કરી આપવી પડશે નહીં તો મહાનગરપાલિકા ના બાંધકામ અધિકારી બીજા કારીગરો પાસેથી દુરસ્ત કરાવી લેશે અને થયેલો ખર્ચ ઇજારદારની લહેણી બીકબતી હોય અગર મહાનગરપાલિકા ત્યાર પછીથી થાય તે રકમમાંથી વસુલ કરી શકશે.~~

- ૨૦) ઇજારદારે પોતાના ખર્ચે રાખેલું કામ પુરું કરવા માટે જોઈતા સર્વ હથિયારો, સાધનો, નિશાનીઓ, દોરડીઓ, પાલખ વિગેરે પુરા પાડવા અને લાવવા લઈ જવા માટેનો ખર્ચ પણ પોતે વેઠવો જોઈએ. તેમણે તેણે કામનું માપ અગર માલસામાનનું માપ લેવા વજન કરવા અગર કામના આલેખને (Linecut) કરવામાં જે સાધનની જરૂર પડે તે કઈ પણ ખર્ચ લીધા વગર આપવી જોઈએ. કોઈના જાનમાલને નુકશાન પહોંચે તે સાડ જોઈતી વાડ અને બત્તીઓની ગોઠવણ કરવી પડશે. સગવડો નહીં રાખવા બદલ દરે ખામી દીઠ રોજના રૂ. ૨/- થી રૂ. ૫/- સુધીનો દંડ કરવામાં આવશે. ખામી બદલની સુચના આપ્યા સિવાય પણ મહાનગરપાલિકા તરફથી તે બિલની વ્યવસ્થા કરી તેનો ખર્ચ કોન્ટ્રાક્ટરના બિલમાંથી વસુલ કરવામાં આવશે. (સ્ટે.ઠ.નં ૮૦૭/તા ૨૯-૧૧-૬૩ થી મંજૂર) તેમજ કામ ઉપર દેખરેખ રાખનાર મહાનગરપાલિકા ના મહેકમ અગર કામ કરનાર મજુરો પૈકી કોઈને પણ મશીનથી અગર ઈતર કોઈ પણ પ્રકારે અકસ્માત થઈ નુકશાન થશે તો તેની તમામ જવાબદારી ઇજારદારને શરિ રહેશે. આવા પ્રસંગે દાવો અગર ફરિયાદ થશે તો તેનો બચાવ કરવામાં અગર ન્યાયની અદાલતમાં લડવા માટે ખર્ચ તે તેણે સોસવો પડશે અને તે માટેનું નુકશાની અગર ખર્ચ આપવા હુકમ થાય તે આપવો પડશે.

- ૨૧) મહાનગરપાલિકા બાંધકામ અધિકારી ની લેખિત સંમતી વગર બીજા નામોમાં બદલો કરી શકાય નહીં અગર બીજા ઈજારદારને પેટા ઈજારો આપી શકાય નહીં . આ પ્રમાણે સંમતી કરી લીધા વગર ઈજારદાર મો બલી કરે અગર પેટા ઈજારો આપે તો તેણે ઈજારદારની શરતો ભંગ કરેલો ગણવામાં આવશે. અને મહાનગરપાલિકા બાંધકામ અધિકારી તે ઉપરથી ઈજારો રદ્દ કરી શકશે અને ઈજારદારે ભરેલી તારણ પેટે રજુ કરેલા અનામત મહાનગરપાલિકા માં જમા થવા પાત્ર થશે અને તે મહાનગરપાલિકા ને સ્વાધીન રહેશે અને ઈજારદારે એકઠા કરેલ માલસામાન થી અગર તે માટે માથે લીધેલી જવાબદારી ઈજારદારને નુકશાન થાય તે માટે વળતર માંગવાનો હકક તેને રહેશે નહીં .
- ૨૨) ભાવપત્રો ઉપર જે ઇસમો સહી કરે તેમની જવાબદારીથી મંડળના ભાગીદારોમાં ફેરફાર થવાથી નષ્ટ થતી નથી આવા ફેરફાર બાબત ઈજારદારે બાંધકામ અધિકારી ને લેખિત ખબર આપવી જોઈએ.
- ૨૩) ~~ઠેકામ પુરુ કરવા માટે તારણ કરવા મુકેલી અનામતની રકમ એટલે ૨% મુજબની અનામત કામ પુરુ થયા પછી છેવટનો હિસાબ થઈ કામ પુરુ થવાનો દાખલ મળ્યા પછી પરત કરવામાં આવશે. નવિન કામો માટે કામ પુરુ થયા પછી એક વર્ષ સુધીની બે ટકાની અનામત મહાનગરપાલિકા તરફ રાખી મુકવામાં આવશે. આ શરતો ખાસ સંપુર્ણ દુસ્તરી કામોને લાગુ કરવી નહીં તે બદલ મહાનગરપાલિકા બાંધકામ અધિકારી મુખત્યાર છે.~~
- ૨૪) ~~જો કામ પુરુ થયાની તારીખથી એક વર્ષ મુદત દરમ્યાન થયેલ કામમાં ઈજારદાર સત્તા બહારના કારણોને લઈને નહીં પરંતુ કેવળ તેની કસુર ખસાવ કામગીરી અથવા ખસાવ માલસામાનનો ઉપયોગ કર્યાનો સબબથી કઈ ખામી જણાઈ આવે તો ઈજારદાર ને ખર્ચ અને જોખમો દુસ્તર કરવામાં આવશે અને થયેલો ખર્ચ ઈજારદાર ને જે રકમ અદા થવાને માત્ર થઈ હોય તેમાંથી વસુલ કરવામાં આવશે.~~
- ૨૫) ઈજારા થી થતાં કામોને તે મુદ્દત દરમ્યાન મહાનગરપાલિકા બાંધકામ અધિકારી હકુમત નીચે ગણાશે અને નુકશાની શરતો અને કામગીરી અને માલસામાનના ગુણદોષ ની બાબતમાં તેમનો નિર્ણય છેવટનો અને બંધનકારક ગણાશે.
- ૨૬) જે કામની બાબતમાં શરતો મુકરર કરવામાં આવેલી ન હોય તે કામો સંપુર્ણ રીતે મહાનગરપાલિકા બાંધકામ અધિકારી ના જરૂરીયાત અને સુચના પ્રમાણે કરવુ પડશે.
- ૨૭) ખાણોની સર્વ લાગત, રોયલ્ટી જાત અને એવા બીજા ખર્ચ તે બાબત ખાસ ઉલ્લેખ કરેલો ન હોય તો તે ઈજારદારે વેઠવો પડશે.
- ૨૮) ~~કવોરીલીઝ બ્લેક ટ્રેપ હોવાનું ગુજરાત સરકારના ખનીજ ખાતાનુ પ્રમાણપત્ર હોવુ જોઈએ. ભુસ્તર વિભાગ દ્વારા જે ખાણો નદીના ભાગમાં આવેલ હોવાનુ પ્રમાણિત કરેલ હશે તેવી ખાણોનું (કવોરીનુ) ભાવપત્ર/ મટીરીયલ સ્વીકારવામાં આવશે નહી. તેમજ ઈજારદારે પીળી માટી ની રોયલ્ટી અંગે સ્પષ્ટતા કરવાની રહેશે.~~
- ૨૯) ~~ઈજારદાર જે કવોરીમાંથી (ખાણમાંથી) માલ લાવવાના/ વાપરવાના હશે તેનું થર્ડ ઇન્સપેક્શન કરાવ્યા બાદ સર્ટીફિકેશન થયેથી જ મટીરીયલ સ્વીકારવામાં / ચુકવણુ કરવામાં આવશે.~~
- ૩૦) ~~આ કામગીરી સંબંધી કોઈ પણ પ્રકારની તકરાર હશે તો ફાયનલ બિલ/ છેલ્લુ પાર્ટ બિલ મળ્યા તારીખથી ૩ મહિના અંદર અમે યોગ્ય ઇલાજ લઈશુ. આ મુદ્દત વિત્યા બાદ આ સંબંધી કોઈ પણ પ્રકારનો દાવો ચાલશે નહીં.~~
- ૩૧) ~~ઈજારદાર હુકમ આપ્યા તારીખથી છ માસની અંદર સંપુર્ણ કામગીરી પૈકીના કોઈ પણ પાર્ટ ભાગની કામગીરી કરવાની સાઈટ આપવામાં ન મળે તો ઈજારદાર કસરમાંથી મુક્ત થવાની માંગણી કરે અને તે પ્રમાણે ઈજારદારે લેખિત માંગણી કરેથી તે અંગે સક્ષમ અધિકારી માંગણીની યોગ્યતા જણાય તો ભરેલ અનામતની રકમ પરત કરી કસરમાંથી મુક્ત કરી શકાશે આવા કિસ્સામાં ઈજારદારે કરેલ ખર્ચાઓનું વળતર માંગી શકશે નહીં.~~
- ૩૨) ઈજારદારે વપરાશમાં લેવામાં આવતા તમામ મટીરીયલનુ ભાવપત્રમાં જણાવ્યા મુજબ ટેસ્ટીંગ પોતાના ખર્ચે તેમજ અત્રેથી નિયુક્ત કરેલ TPI ની સાક્ષીમા કરાવી લેવાની જવાબદારી ઈજારદારની રહેશે. ઈજારદાર જે સરકાર / વડોદરા મહાનગરપાલિકા માન્ય લેબોરેટરી પાસે ટેસ્ટીંગ કરાવવાના હોય તે ટેસ્ટીંગ લેબોરેટરી દ્વારા કામની સાઈટ ઉપરથી માલસામાનના નમૂના લેવાના રહેશે તથા ટેસ્ટીંગ રીપોર્ટમાં માલસામાન લેબોરેટરીના પ્રતિનિધી દ્વારા લેવામાં આવેલ છે તેમ ઉલ્લેખ કરવાનો રહેશે. જો ટેસ્ટીંગ કરાવવામાં ન આવ્યુ હોય તો સક્ષમ અધિકારી નક્કી કરે તે મુજબ કામગીરી થયા પછીના ટેસ્ટીંગ અને એવી કામગીરીને યથાવત સ્થિતીમાં લાવવાની જવાબદારી ઈજારદારની રહેશે. અને તેનો ખર્ચ પણ તેઓએ ભોગવવાનો રહેશે અથવા સક્ષમ અધિકારી ટેસ્ટીંગ વગર કરેલ કામગીરીનું કોઈ પણ ચુકવણુ ન કરવા નિર્ણય કરી શકશે.

૩૩) ઇજારદારે કોન્ટ્રાક્ટ ઓલ રીસ્ક પોલીસી (CAR Policy) ઉતારવાની રહેશે જેમાં નીચેના મુદ્દાનો સમાવેશ કરવાનો રહેશે.

- કામનું નામ (જાહેરમાં પ્રસિદ્ધ થયા મુજબનું)
- ઇજારદારનું નામ (જો સંસ્થા હોય તો તેના પ્રોપરાઇટર કે પાર્ટનરોના નામો) અને મહાનગરપાલિકાના મ્યુનિસિપલ કમિશનરનો ઉલ્લેખ હોવો જોઈએ.
- વિમાની રકમ ઓછામાં ઓછી ભાવપત્રની રકમ જેટલી હોવી જોઈએ.

૩૪) કરેલ કામગીરીનું ચુકવણુ કરવા માટે સામેલ પત્ર /બિલ મુજબ ઇજારદારની બીલનું ચુકવણુ કરવાની માંગણી આવ્યા બાદ જ બીલની ચુકવણીની કાર્યવાહી કરવામાં આવશે. જો ઇજારદાર દ્વારા બિલ રજુ ના થવાના કિસ્સામાં જરૂર જણાયે મહાનગરપાલિકા બિલ ઉપસ્થિત કરી પ્રક્રિયા પૂર્ણ કરશે અને સદર બાબતે કામના માપ તથા ભાવ ઇજારદારને માન્ય રાખવા અંગે કોઈપણ તકરાર કરી શકશે નહીં.

૩૫) આ ઉપરાંત ઇજારદારે સામેલ નમૂનો મુજબનો કરાર કરવાનો રહેશે.

૩૬) ઇજારદારે કામગીરીની જેટલી સાઈડ ખુલ્લી હોય એટલે કે દબાણ/સંપાદન કે અન્ય કોઈ સર્વિસ લાઈનની નડતરરૂપ કામગીરી સિવાય કોઈ અડચણ ન હોય તેવું તમામ કામ નિશ્ચિત સમય મર્યાદામાં જ પૂર્ણ કરવાનું રહેશે.

૩૭) ખોદાણ કામનું માપ ઘ.મી.ના ધોરણે આપવામાં આવશે. એમાં કોઈપણ પ્રકારનો બલ્કેજ આપવામાં આવશે નહીં.

૩૮) ઇજારદારે કામગીરીનો વર્ક ઓર્ડર આપ્યા બાદ કે કરાર કર્યા બાદ સ્થળે કામગીરી શરૂ કર્યા બાદ (આ ત્રણે પૈકી જે પ્રથમ થાય) ભરેલ ભાવપત્રની શરતો કે કરારની શરતો કે પત્રો દ્વારા આપેલ સંમતીઓનો ભંગ થાય તો સક્ષમ અધિકારી કે તેના પ્રતિનિધી દ્વારા પ્રાથમિક એક અને વધારેમાં વધારે ત્રણ સુચના આપ્યા બાદ , સુચનાનો અમલ ન થાય તે સંજોગોમાં ઇજારદારને કરેલા કામનું યોગ્ય જણાય તેટલું ઓછું ચુકવણુ કે કોઈ પણ ચુકવણુ ન કરવાનું કે ઇજારદારે ભરેલ તમામ અનામતો જમ કરવાનું કે મહાનગરપાલિકાના કોઈ પણ કામોમાંથી આવી વસુલાત ઇજારદાર પાસેથી કરી શકશે અને આ ઉપરાંત ઇજારદારને કાળી ચાદીમાં મુકી શકશે. કાળી ચાદીમાં મુકીને સરકારશ્રી અર્ધ સરકારી સંસ્થામાં તેમજ કેન્દ્ર સરકારની કચેરીમાં જાણ કરવામાં આવશે. કાયદાકીય પગલાઓમાં ફોજદારી કાર્યવાહીનો પણ સમાવેશ થાય છે.

૩૯. વડોદરા મહાનગર પાલિકામાં રજીસ્ટ્રેશન ન ધરાવતા ઇજારદારે વર્કઓર્ડર મળ્યે દિન-૩૦ માં વડોદરા મહાનગર પાલિકા નું રજીસ્ટ્રેશન મેળવી લેવાનું/રીન્યુ કરાવી લેવાનું રહેશે.

૪૦) ઇજારદારે સદર બાંધકામની વિગતો તથા સ્પેશીફિકેશન દર્શાવતા બોર્ડ કામના સ્થળે સ્વખર્ચે મુકવાના રહેશે.

૪૧) ઇજારદારે ફાઈનલ બીલ થયા બાદ જે તે અનામત જે નિશ્ચિત સમયગાળા બાદ છુટી કરવાપાત્ર હોય તે સમયથી વધુમાં વધુ ૬ માસની અંદર અનામત છુટી કરવા માંગણી રજુ કરવી. સદર સમયગાળા બાદ અનામત છુટી કરવા માટે થયેલ રજુઆત અંગે અત્રેની કચેરીએથી કાર્યવાહીમાં વિલંબ થયેથી અને અન્ય કોઈ રજુઆત ગ્રાહ્ય રાખવામાં આવશે નહીં.

૪૨) કોન્ટ્રાક્ટરે GST સિવાયના ભાવો ભરવાના રહેશે. આ કામ અર્થે ઇજારદારને GST ની રકમ અલાયદા ચુકવવામાં આવશે.

જૃૃ) ઇજારદારે કામના સ્થળે MOVING ટ્રાફીક તેમજ રાહદારીઓની સલામતી માટે જરૂરી તમામ સંબંધિત પગલા લેવાના રહેશે. રસ્તા, ફૂટપાથ, ડીવાઈડર તથા વરસાદી ગટરના કામ માટે રોડની ઘારે/જંકશન પર પતરાં/પ્રીકાસ્ટ પેનલ/એમ.એસ. બેરીકેડસ લગાવવાના રહેશે. તથા દિવસે તેમજ રાત્રીના સમયે દેખાય તેવા સાઈનેજીસ/સુચક બોર્ડ / રીફ્લેક્ટર/રેડીયમ લગાવવાના રહેશે. આ માટે કોઈ ઇલાયદા ચુકવણું કરવામાં આવશે નહીં. સ્થળ પરનાં પ્રગતિમાં હોઈ તેવા કામો માટે સુરક્ષા તથા સલામતી અનલ્લે ચુક થયેથી અથવા અનિવાર્ય સંજોગોમાં કોઈ અકસ્માત સર્જવાની પરિસ્થિતીએ થતી તમામ વહીવટી તથા કાયદાકીય બાબત અનલ્લે ઇજારદારની સંપુર્ણ જવાબદારી રહેશે,

ભાવપત્ર કરનાર ઇજારદાર અગર ભાગીદારોની સહી ઓ

મતુ કરનાર ઇજારદાર ભાગીદારોના સાથીદારોની સહી

રૂબરૂ

મ્યુનિસિપલ કમિશનર

વડોદરા મહાનગરપાલિકાનો સિક્કો



વડોદરા મહાનગરપાલિકાના સભ્ય નં

પી.એફ.રજીસ્ટ્રેશન અંગેનું બાંહેધરીપત્ર

૧. ઈજારદારનું નામ :
૨. સરનામું :
૩. રજીસ્ટ્રેશન વર્ગ :
૪. ખાતાનું નામ :
૫. કામનું નામ :
૬. ટેન્ડરની રકમ :

આથી હું ઈજારદાર -----
----- બાંહેધરી આપુ છું કે વડોદરા મ્યુનિસિપલ કોર્પોરેશનમાં હું ઈજારદાર તરીકે કામ કરુ છુ / કરવા માંગુ છું. હાલ મને પી.એફ એકટની જોગવાઈ અનુસાર પી.એફ રજીસ્ટ્રેશનની જરૂર ન હોઈ હાલ મને તે લાગુ પડતુ નથી.

મ્યુનિસિપલ કોર્પોરેશન સાથેના મારા રજીસ્ટ્રેકશનના સમયગાળા દરમ્યાન અગર તે રજીસ્ટ્રેશન હેઠળ મેળવેલ ટેન્ડરની કામગીરી પુર્ણ થવાના સમયગાળા દરમ્યાન EPF એકટમાં નમુદ કરેલ રજીસ્ટ્રેશનની નિદિષ્ટ સંખ્યા કરતાં ઓછું માનવબળ રાખવાના છે અને જો તે સંખ્યા વધશે તો EPF કરાવી લેવામા આવશે અને તેની નકલ વડોદરા મ્યુનિસિપલ કોર્પોરેશનને આપવામાં આવશે તેમછતાં EPF એકટ અન્વયેની કોઈપણ જવાબદારી ઉભી થશે તો તેની સઘળી જવાબદારી હમારી રહેશે તેની અમો બાંહેધરી આપીએ છીએ.

ઈજારદારની સહી. -----

વડોદરા મ્યુનિસિપલ કોર્પોરેશન

પ્રી-કવોલીફિકેશન બીડ સાથે સ્કેન ઇમેજમાં મોકલવાના ડોક્યુમેન્ટ્સની યાદી

તમામ ભાવપત્રો છેલ્લામાં છેલ્લા માન્ય દસ્તાવેજ પત્રો સાથે મોકલવા

(૧) વડોદરા મ્યુનિસિપલ કોર્પોરેશનમાં યોગ્ય શ્રેણી અને " E1 " વર્ગ કે તેથી વધુ રકમનું રજીસ્ટ્રેશન ધરાવતા ઇજારદારો માટે.

(અ) કામ માટે જરૂરી ૨ ટકા ઇ.એમ.ડી નો ડીમાન્ડ ડ્રાફ્ટ દ્વારા મોકલવાની છે.

(બેંક ગેરેંટી સ્વીકારવામાં આવશે નહીં.) પરીપત્ર અંક ૨૨ /૨૦૧૮-૧૯ તા.

૧૨/૦૮/૨૦૧૮ મુજબ

(બ) વડોદરા મ્યુનિસિપલ કોર્પોરેશનમાં યોગ્ય શ્રેણી અને " E1 " વર્ગ કે તેથી વધુ રકમનું રજીસ્ટ્રેશનના સર્ટીફિકેટની પ્રમાણીત નકલ.

(૨) વડોદરા મ્યુનિસિપલ કોર્પોરેશનમાં માન્ય ઇજારદાર તરીકે રજીસ્ટ્રેશન નહીં ધરાવતા ઇજારદારો તરફથી નીચેના પત્રોની પ્રમાણીત નકલો રજુ કરવાની રહેશે.

(અ) સરકારી અર્થ/સરકારી સંસ્થાનું માન્ય ઇજારદાર તરીકે " E1 " વર્ગ કે તેથી વધુ રકમનું રજીસ્ટ્રેશન સર્ટીફિકેટની પ્રમાણીત નકલ

(બ) કામ માટે જરૂરી ૨ ટકા મની ઇ.એમ.ડી નો ડીમાન્ડ ડ્રાફ્ટ રજુ કરવો.

(ક) છેલ્લામાં છેલ્લું ઇન્કમેટેક્સ રીટર્નની પ્રમાણીત નકલ

(ડ) લેબર એક્ટ હેઠળ મેળવેલ સર્ટીફિકેટની પ્રમાણીત નકલ

(ઇ) છેલ્લા સાત વર્ષમાં ઇજારદારે કરેલા કામોના કંપલીશન સર્ટીફિકેટની

પ્રમાણીત નકલો અને હાથ ઉપરના કામોની વિગતોના જરૂરી પત્રો.

(ઇ) જરૂરી રકમની બેંક સોલવન્સી સર્ટીફિકેટની પ્રમાણીત નકલ.

૩) ઇજારદારશ્રીએ છેલ્લા સાત વર્ષમાં આ જ પ્રકારનાં એટલે કે ટ્રાફિક રોડ ફર્નિચર (કેટ્સ-આઈ, મીડીયન માર્કર, સોલાર સ્ટડ, AFP (Aluminum backed flexible prismatic sheeting), ડેલીનેટર્સ, રેટ્રો રીફ્લેક્ટીવ શીટ)નું કોઈપણ એક કામ રૂ.૨૫ લાખ કે તેથી વધુનું તથા થર્મોપ્લાસ્ટિક પેઇન્ટનાં કોઈપણ ત્રણ કામ રૂ.૫૦ લાખ કે વધુનાં પુર્ણ કરેલા હોવા જોઈએ. જેનાં ફોર્મ-૩A (Completion certificate) રજુ કરવાનું રહેશે.

નોંધ:- ઉપરોક્ત દર્શાવેલ મુદ્દા નંબર ૧ થી ૩ માં જણાવેલ તમામ ડોક્યુમેન્ટ સ્કેન ઇમેજમાં આવવા જરૂરી છે. આ પૈકીનું ડોક્યુમેન્ટ સ્કેન ન થવાના પ્રસંગે ઇજારદાર ડીસકવોલીફાય થવા પાત્ર રહેશે.

ઉપરોક્ત તમામ દસ્તાવેજો -પત્રો પ્રી-કવોલીફિકેશન બીડ સાથે અચૂક સામેલ રાખવા.ઇજારદારે પ્રી-કવોલીફિકેશન બીડ સીલ કવરમાં,કવર ઉપર કામનું નામ તથા ખાતાનું નામ દર્શાવી **કાર્યપાલક ઇજનેર, ટ્રાફિક શાખા , કુમાર શાળા નં ૧, દુલીરામ પેંડાવાળાની સામે, વડોદરા મહાનગરપાલિકા** ખાતે મોકલવાનું રહેશે.

પ્રી-કવોલીફિકેશન બીડ ભાવપત્ર ખોલવાની તારીખ/સમયે ખોલવાના છે. જે પછી જ પ્રી-કવોલીફિકેશન બીડની ચકાસણી કરી, માન્ય પ્રી-કવોલીફિકેશન બીડ વાળા ઇજારદારના જ પ્રાઇસબીડ સક્ષમ અધીકારીશ્રીની પૂર્વ મંજૂરી મેળવી ખોલવાના છે.

નોંધ:- અમાન્ય પ્રી-કવોલીફિકેશન બીડના ઇજારદારોના પ્રાઇસબીડ ખોલવામાં આવશે નહીં.

વડોદરા મ્યુનિસિપલ કોર્પોરેશનને તમામ ભાવપત્રો અમાન્ય કરવાના અબાધીત અધીકાર રહેશે. તેના માટે કોઈ કારણ આપવામાં આવશે નહીં.

ઇજારદારની સહી :

શાખા/ખાતાઅધીકારી
વડોદરા મ્યુનિસિપલ કોર્પોરેશન
વડોદરા

વડોદરા મ્યુનિસિપલ કોર્પોરેશન
(ટ્રાફિક શાખા)

*** શરતો ***

૧. ટેન્ડર રજીસ્ટર પોસ્ટથી મોકલવાની છેલ્લી તા.૦૧/૦૭/૨૦૨૬ સમય-૧૬-૦૦ કલાકનો છે.
૨. ઈ-ટેન્ડરીંગથી ભરેલા ટેન્ડરના પ્રી-બીડ ડોક્યુમેન્ટ સોફ્ટ કોપી દ્વારા જ ઓનલાઈન ટેન્ડર ભરવાનું રહેશે. ત્યારબાદ સોફ્ટકોપીને આધારે જ તેનું ઇવેલ્યુએશન કરવામાં આવશે. સદર ટેન્ડરની હાર્ડ કોપીના દરેક પાન ઉપર સહી સીક્કા સાથે રજુ કરવાની રહેશે. સદર ટેન્ડરની પ્રાઈસ બીડની હાર્ડ કોપીને ભાવપત્રની સ્વીકૃતિ માટે માન્ય રાખવામાં આવશે નહીં.
૩. ડીમાન્ડ ડ્રાફ્ટ સામેલ છે તેમ દર્શાવી ડીમાન્ડ ડ્રાફ્ટની વિગત આપવી.
૪. ટેન્ડર ભરતી વખતે સીલ બંધ કવર ઉપર સંપૂર્ણ કામનું નામ જણાવવું.
૫. ટેન્ડર ભરવામાં બોલપેનનો ઉપયોગ કરવાની મનાઈ છે. આ સુચનાનું ઉલ્લંઘન કરવામાં આવે તો ટેન્ડર ના મંજૂર કરવાનો અધીકાર મહાનગરપાલિકાનો છે.
૬. અનિવાર્ય સંજોગોમાં રજીસ્ટર પોસ્ટથી રજુ કરેલ ટેન્ડર સ્વીકારવાનો ઉપર દર્શાવેલ તારીખ અને સમય ૧૬-૦૦ કલાકનો છે તે પહેલા ટેન્ડરપત્ર મળી શકશે તો જ ટેન્ડર સ્વીકારવામાં આવશે પોસ્ટથી નીચત સમય પછીનો ટેન્ડર સ્વીકારવામાં આવશે નહીં. અને તેની જવાબદારી મહાનગરપાલિકાની રહેતી નથી.
૭. બાનાની રકમ ડીમાન્ડ ડ્રાફ્ટથી સ્વીકારવામાં આવશે. રોકડા ફીક્સ ડીપોઝીટ બાજુના સ્વરૂપમાં સ્વીકારવામાં આવશે નહીં.

૮. અદાજમાં સમાવિષ્ટ આઈટમો GST સિવાયના ભાવ મુજબની છે. ઈજારદારે GST સિવાયના ભાવો મુજબ ભાવપત્ર ભરવાનું છે. હિસાબી શાખાના પરિપત્ર અંક ૨૩/૨૦૧૭-૧૮ તા. ૨૯/૦૬/૨૦૧૭ મુજબ હાલના GSTનાં દર ૧૮% મુજબના છે. કામના અમલ દરમિયાન GST દરમાં ફેરફાર (વધારો-ઘટાડો) થવાના કિસ્સામાં વડોદરા મહાનગરપાલિકા દ્વારા ચુકવણું/વસુલાત કરવામાં આવશે.

૯. PQ ડોક્યુમેન્ટ અને ટેન્ડર ડોક્યુમેન્ટ વ્યવસ્થિત અનુક્રમણિકા ભરીને સ્પાઈરલ બાઈન્ડીંગ કરીને સીલબંધ કરવામાં આપવાનું રહેશે.

૧૦. રજીસ્ટર પોસ્ટથી પ્રિ-કવોલીફિકેશન બીડ નીચેના સરનામે મોકલવું.

કાર્યપાલક ઇજનેરશ્રીની કચેરી

ટ્રાફિક શાખા

રાવપુરા કુમારશાળા નં-૧

વડોદરા મહાનગરપાલિકા

વડોદરા- ૩૯૦૦૦૦૧

ઈજારદારની સહી

કાર્યપાલક ઇજનેર (ટ્રાફિક શાખા)

વડોદરા મ્યુનિસિપલ કોર્પોરેશન

-: શરતો :-

૧. સદર વાર્ષિક ઇજારા અંગેની કામગીરી જ્યારે લેખીત/મૌખિક બતાવવામાં આવે ત્યારે તાત્કાલીક સમય મર્યાદામાં તેમજ કામગીરી સ્પેશીફિકેશનમાં દર્શાવ્યા મુજબ કરવાની રહેશે. અન્યથા ઇજારો રદ કરવામાં આવશે અને તમામ અનામત જપ્ત કરવામાં આવશે.
૨. ઇજારા અંગે ઓછા/વધુ ટકાનુ ભાવપત્ર ભરવાનુ રહેશે.
૩. ઇજારદારે વાર્ષિક ઇજારાથી ટ્રાફિક શાખા માટે વિવિધ ઝોન વિસ્તારનાં રસ્તાઓ પર ટ્રાફિક નિયમન માટે જુદા જુદા પ્રકારના ટ્રાફિક ફિક્સર લાવી લગાવી આપવાનું તથા થર્મોપ્લાસ્ટીક પેઇન્ટથી લાઇના માર્કિંગ કરવાની કામગીરી કાર્યપાલક ઇજનેરશ્રી ટ્રાફિક શાખા દ્વારા તેઓના વિસ્તારમાં બતાવવામાં આવે ત્યાં કરવાની રહેશે.
૪. સદર વાર્ષિક ઇજારા પેટે જે તે કામગીરી કરવાનો વર્ક ઓર્ડર નોટીસ કે ચુકવણું કાર્યપાલક ઇજનેરશ્રી ટ્રાફિક શાખા પાસેથી લેવાપાત્ર રહેશે.
૫. વડોદરા શહેરમાં મુખ્ય રસ્તાઓના ટ્રાફિક નિયમન માટે વાર્ષિક ઇજારાથી ટ્રાફિક શાખામાં અત્રેથી સુચવ્યા મુજબ વિવિધ ઝોનમાં ટ્રાફિક નિયમન માટે જુદા-જુદા પ્રકારના ટ્રાફિક ફિક્સર લગાવવાનું તથા થર્મોપ્લાસ્ટીક પેઇન્ટથી પટ્ટા પાડવાની કામગીરી દરમ્યાન કરવાની થતી વિવિધ કામગીરીઓના એસ.ઓ.આર./મંજુર ભાવો (યુનિટ રેટ) જે તે આઈટમ સામે દર્શાવવામાં આવેલા છે. આ તમામ કામગીરીઓ ઇજારદાર કેટલા ટકા વધુ અગર ઓછાથી કરવા સંમત છે. તે શબ્દોમાં તથા આંકડામાં ઇજારદારે ભાવપત્રના પાન નં ૧૭ પર સ્પષ્ટપણે દર્શાવવાના રહેશે. ઇજારદારે કોઈ પણ આઈટમના ભાવો આપવાના નથી.
૬. સદર વાર્ષિક ઇજારામાં અત્રેથી જણાવ્યા મુજબ ટ્રાફિક નિયમનના બોર્ડની કામગીરી પણ કરી આપવાની રહેશે.
૭. Contractor must have to submit a certificate of being authorized converter of approved manufacturers as per specification and usage conformation certificate of approved brand and manufacture
૦૮. વડોદરા મ્યુનિસિપલ કોર્પોરેશનનાં ઇજનેર ટ્રાફિક પ્રોજેક્ટ દ્વારા શહેરનાં જુદા જુદા ટીપી રોડ ઉપર થર્મોપ્લાસ્ટીક પેઇન્ટ કરાવવા માટે IRC-૩૫-૨૦૧૫ ગાઈડ લાઇન મુજબ MORTH Clause No.૮૦૩.૪ પ્રકારનું મટીરીયલનું જુદી જુદી કંપનીઓ દ્વારા ઉત્પાદન કરવામાં આવે છે પરંતુ ક્વોલીટીનાં ધારા ધોરણ મુજબ તેમજ કાયમી એક ધારા મટીરીયલ મળી શકે તે માટે વિશ્વાસ પાત્ર કંપનીઓની એપ્રુવ્ડ બ્રાંડની બનાવટ વાપરવાની થતી હોઈ મુખ્ય કંપનીઓની બ્રાંડ વાપરવા માટે R.A બનાવી મંજુર કરાવેલ છે. એપ્રુવ્ડ બ્રાંડનાં નામ આઈટમ સ્પેશીફિકેશનમાં દર્શાવેલ છે જે મુજબ સદર કામનાં કોન્ટ્રાક્ટર પાસે કામગીરી કરાવવામાં આવશે તેમજ એપ્રુવ્ડ બ્રાંડનાં મટીરીયલનાં ઉપયોગ કરેલ કામગીરીનું અનુભવ સર્ટીફિકેટ તેમજ એપ્રુવ્ડ બ્રાંડનાં ઓથોરાઇઝ્ડ કન્વર્ટરનું સર્ટીફિકેટ સામેલ કરવાનું રહેશે.

૦૯ .ઈજારદારે વપરાશમાં લેવામા આવતા તમામ મટીરીયલના કંમ્પનીનું MTC રજુ કરવાનું રહેશે. તથા સક્ષમ અધીકારીને જરૂર જણાશે તો તેઓ નકકી કરે તે મુજબના IS/MORTH/IRC માં જણાવ્યા મુજબ સેમ્પલીંગ કરી સરકાર માન્ય લેબોરેટરીમાં ટેસ્ટીંગ કરવાનું રહેશે. જે અંગેનો સંપૂર્ણ ખર્ચ ઈજારદારશ્રીએ પોતે ભોગવવાનો રહેશે.

૧૫. ઈજારા અંતર્ગત તમામ કામગીરીઓ માટે ૧ વર્ષ ની પરફોમન્સ ગેરેન્ટી આપવાની રહેશે.

૧૬. સદર કામગીરી માં જો ઈજારદાર નીષ્ફળ નીવડશે તો આ કામગીરી અન્ય ઈજારદાર પાસે મુળ ઈજારદારના ખર્ચે અને જોખમે કરાવી શકાશે અને તેને ચુકવવા પાત્ર બીલ ની રકમ,મુળ ઈજારદારનાં વડે મ્યુનિસિપલ કોર્પોરેશનમાં કોઈપણ ટ્રાફિક વિભાગને લાગત કામનાં બીલ/અનામત માંથી કપાત કરી અન્ય ઈજારદાર પાસે કામ કરાવી શકાશે અને ઈજારદારને કાળીયાદીમાં મુકવામાં આવશે.

૧૭. ઈજારદારે આરબીટ્રેશનમાં કોઈ દાવા હોય તો તેની વિગત આપવાની રહેશે. માન્ય ઈજારદાર હોવા અંગે જરૂરી સરકારી રજી.સર્ટીફિકેટ રજુ કરવાનું રહેશે.

૧૮. ઈજારદારે વિવાદ બાબતે તેની કોઈ પણ શરત અંગે ભવિષ્યમાં કઈ વિવાદ ઉપસ્થિત થશે તો તે પ્રસંગે ઈન્ડિયન આરબીટ્રેશન એક્ટ ૧૯૪૦ ની જોગવાઈઓ તેમજ વખતો વખત તેમાં થયેલા સુધારા હેઠળની જોગવાઈઓ મુજબ કોર્પોરેશન સોલ આરબટ્રેટર નિમશે અને તેવા વિવાદના જે કોઈ નિર્ણય આવશે તે આખરી ગણાશે. અને બંન્ને પક્ષકારોને બંધનકર્તા રહેશે.

૧૯. સદર કામના કરાર કે તેની કોઈ પણ શર્તો અંગે કોઈ વિવાદ ઉપસ્થિત થશે તો તે ફક્ત નામદાર વડોદરાના કોર્ટની હકુમતને આધીન રહેશે.

૨૦ . કોઈ પણ અથવા બધા જ ભાવપત્રકો કોઈ પણ કારણ જણાવ્યા વગર મંજૂર/ નામંજૂર કરવાની અબાધીત સત્તા મ્યુનિ. કમિશનરશ્રીને રહેશે.

૨૧. ખાસ સંજોગોમાં સદર કામગીરી અગ્રીમતાના ધોરણે સમય મર્યાદામાં કરવાની થતી હોઈ, અત્રેથી સુચના મળ્યેથી તાત્કાલીક કામગીરી શરૂ કરી પુર્ણ કરી આપવાની રહેશે.

૨૨. સ્થળ ઉપર કામગીરી દરમ્યાન આપના તરફથી જુદા-જુદા પ્રકારના ટ્રાફિક ફિક્સર તથા થર્મોપ્લાસ્ટીક પેઇન્ટની કામગીરીના અનુભવી/નિપુણતા ધરાવતા સુપરવાઇઝર/એન્જનીયરની હાજરી અવશ્ય (બીન ચુક) રાખવી.

૨૩. જો ઈજારદાર વડોદરા મહાનગરપાલિકાના હદ્દ વિસ્તારની બહારના હોય તો તેઓએ વાર્ષિક ઈજારાનો મુળ વર્ક ઓર્ડર મળ્યા બાદ કામગીરીના સુચારૂ આયોજન માટે વડોદરા મહાનગરપાલિકાની હદ્દમાં તેઓની ઓફીસ કાર્યરત કરવાની રહેશે.

ઈજારદારની સહી.



VADODARA MUNICIPAL CORPORATION
TECHNICAL SPECIFICATION

ITEM WISE SPECIFICATION

આયટમ નંબર ૧. માટી ખોદાણ કરવાનું કામ.

૧. ખોદાણ કામ કોઈ પણ પ્રકારની માટી, રેતી, નરમ મુરમમાં લાઇન લેવલ, કેમ્બર મુજબ કરવાનું રહેશે. ખોદેલી માટી રબીશ વિગેરે અત્રેથી બતાવવામાં આવે તે મુજબ ૫૦ મીટર સુધી લીડમાં ભેગી કરવાની સુચના પ્રમાણે પાથરી આપવાની તથા લીડની મર્યાદામાં પુનઃ બતાવેલ સ્થળે ભરી આપવાની રહેશે અને ૫૦ મી.થી વધુ લીડ હોય તેવા કિસ્સામાં આર.એન્ડબી, એસ.ઓ.આર. મુજબ ભાવ આપવામાં આવશે.
૨. ખોદાણ બાદ સબગ્રેડ અત્રેથી ચેક કરાવ્યા બાદ જ આગળની કામગીરી કરવાની રહેશે. ઉપરાંત ખોદાણ કરતા પહેલા સ્થળે ઉગી નીકળેલ ઘાસ, છોડ વિગેરે ઇજારદારે દૂર કરી સાઇટ ચોખ્ખી કરવાની રહેશે.
૩. સ્થળે કામ ચાલુ કરતા પહેલા વાહન વ્યવહારના નિયમન માટે ઇજારદારે 'રસ્તો બંધ છે' વિગેરે દર્શાવતા બોર્ડ, લાલબત્તી ચોકીદાર રાખવા વિગેરેની વ્યવસ્થા પોતાના ખર્ચે તથા જોખમે કરવાની રહેશે. ખોદાણ કામ માટે લાઇન લેવા માટેનો સામાન જેવો કે દોરી ચુનાની ફાંક ખુટી વિગેરે ઇજારદારે સ્વખર્ચે લાવવાની રહેશે.
૪. ખોદાણની કામગીરી શરૂ કરતા પહેલા ટ્રાયલ પીટ લઈ સર્વેસ લાઇનની ખાતરી કરી કામગીરી કરવાની રહેશે. . ખોદાણમાં આવતા પાણીની લાઇન, ગટરની લાઇન તથા ગેસ લાઇન તથા જોડાણ ઇલેક્ટ્રીસિટી તથા ટેલિફોન વિગેરેની લાઇનો તથા કેબલોને કોઈ પણ જાતનું નુકશાન થશે તો તેની સંપૂર્ણ જવાબદારી ઇજારદારની રહેશે. અને તે અંગે જરૂરી દુરસ્તી અથવા નવીન કામગીરી ઇજારદારે પોતાના ખર્ચે વહેલી તકે સંતોષકારક રીતે કરી આપવાની રહેશે. જો તે પ્રમાણેની દુરસ્તી અથવા નવીન કામગીરી ઇજારદારે પોતાના ખર્ચે વહેલી તકે સંતોષકારક રીતે કરી આપવાની રહેશે. જો તે પ્રમાણેનું દુરસ્તી અથવા નવીન કામગીરી તાત્કાલિક કરી આપવામાં આવશે નહીં તો તે કામ બીજી એજન્સી અથવા બીજા ખાતા મારફતે અત્રેથી કરાવી લેવામાં આવશે અને તેની દુરસ્તી અંગેના તમામ ખર્ચ ઇજારદારના બીલમાંથી અથવા બીજી લેણી રકમમાંથી વસુલ કરવામાં આવશે.
૫. સદર કામનું માપ ઘનમીટરના ધોરણે આપવામાં આવશે.

આયટમ નંબર :૨: ખોદાણમાંથી નીકળેલ વધારાની માટી ઉપાડવાનું કામ :

ખોદાણ/કામ સ્થળ પરની વધારાની માટી, રોડા, રબીશ વિગેરે અત્રેની સુચના મુજબ ઉપાડવાનું રહેશે.

ઉપાડેલ મટીરીયલ અત્રેની સુચના મુજબ મ્યુનિ. હદમાં બતાવ્યા મુજબ ના સ્થળેથી ખાલી કરી આપવાનું / પાથરી આપવાનું રહેશે.

સદર કામનું માપ ઘ.મી ના ધોરણે આપવામાં આવશે. એમા કોઈ પણ પ્રકારનો બલ્કેજ આપવામાં આવશે નહીં.

ITEM NO.3

૧:૨:૪ ના પ્રમાણમાં કોકીટ કરવાનું કામ

૧. સિમેન્ટ આઇ.એસ. ૧૨૨૬૯/૧૯૮૭ પ્રમાણેનો આઇ.એસ.આઇ માન્ય સિમેન્ટ વાપરવાનો રહેશે. સિમેન્ટ રાખવા સ્થળ ઉપર બરાબર વ્યવસ્થા કરવામાં આવશે. સીમેન્ટના સ્ટોરમાં દસ દસ થેલીની થપ્પી કરવી.

૨. રેતી ઓરસંગની વાપરવાની રહેશે. રેતીમાં માટીનું પ્રમાણ ૩ % થી વધુ ચાલશે નહીં.

ITEM NO.4

Applying priming coat over new steel and other metal surface after and including preparing the surface by thoroughly cleaning, oil, grease, dirt and other foreign matter and scoured with brushes fine steel wood, scrapers and sand paper with ready mixed priming paint brushing red lead..

ITEM NO:-5

19.21. Painting one coat (excluding priming coat) on previously painted steel and other metal surfaces with synthetic enamel

paint brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials & Workmanship : 1.1. The relevant specifications of item No. 19.19 shall be followed except that the

painting shall be carried out on previously painted steel and other metal surfaces using synthetic enamel paint in one coat.

2 0. Mode of measurements & payment:

2.1 The relevant specifications of item No. 19.19 shall be followed.

2.2. The rate shall be for a unit of one sq. metre.

ITEM NO:-6

19.7. Painting two coats (excluding priming coat) on new steel and other metal surfaces with enamel paint, brushing, interior to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials : The enamel paint shall conform to M-44 B.

2.0 Workmanship :

2.1. General:

2.1.1. The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums, kegs etc. with seal unbroken.

2 1.2. All materials not in actual use, shall be kept properly protected, lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials which have become stale or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins. When not in use, the containers shall be kept properly closed.

2.1.3. If for any seasons, thinning is necessary, the brand of thinner recommended by the manufacturer shall be used.

2.1.4. The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, damp or otherwise unfavourable weather and all the surfaces shall be thoroughly dry before painting work is started.

2.2. Application:

2.2.1. Brushing operations are to be adjusted to the spreading capacity advised by the manufacture of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brushmarks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2. Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from Engineer-in-charge before next coat is started.

2.2.3. Each coat except the last coat shall be lightly rubbed down with sand paper of fine pumice stone and cleaned of dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corners of panels angles of mouldings etc. shall be left on the work.

2.2.4. Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc. Approved best quality brushes shall be used.

3.0. Mode of measurements & payment:

3.1. The relevant specifications of item No. 19.12 shall be followed for mode of measurements and payment. The rate is excluding priming coat.

3.2. The rate shall be for a unit of one sq. metre.

Item no :-7

Cat Eye / Road Stud / RPM: Supplying of Molded Twin Shanks Raised Pavement Markers made of polycarbonate and ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 13635 kgs. tested in accordance to ASTM D 4280 Type H and complying to Specifications of Category A of MORTH Circular No RW/NH/33023/10-97 DO III Dt 11.06. 1997. The height, width and length shall not exceed 20 mm, 130 mm and 130 mm and with minimum reflective area of 13 Sqcm on each side and the slope to the base shall be 35 +/- 5 degree. The strength of detachment of the integrated cylindrical shanks, (of diameter not less than 19 +/- 2 mm and height not less than 30 +/- 2 mm) from the body is to be a minimum value of 500 Kgf. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturers recommendation and The color of the marker should be as per the IRC 35-2015 and as directed by Engineer-in-charge. R&B SOR 2021-22 Ch -26 Item code-26162 A

Details specification for this item :- Material & Manufacturing

1. Scope

- 1.1** The work shall cover the providing and fixing of Raised Pavement marker (RPM) or road stud, a device which is bonded to or anchored within the road surface, for lane marking and delineation for night-time visibility, as specified in the contract.

2. Material

- 2.1** Plastic body of RPM road stud shall be molded from ASA (Acylicstyrene actylonitrile) or HIPS (Impact polystyrene) or ABS or any other suitable material approved by the Engineer in charge. The marker shall support a load of 13635 kg. tested in accordance with ASTM D 4280
- 2.2** Reflective panels shall consist if number or lenses containing single or dual prismatic cubes capable of providing total internal reflection the light entering the lens face lenses shall be molded of methyl methecrylat conforming to ASTM D 788 or equivalent.

3. Design

The slope or retro reflecting surface shall prfeably be 35. + 5degree to base. The area of each retro reflecting surface shall not be less then 13.0 sqmt.

4. Optical performance

- 4.1** Unidirectional and bi directional studs Each reflector or combination of reflector on each face of the stud shall have a CIL not less the given in Table 1 or 2 appropriate.
- 4.2** Omni directional studs
Each omni directional stud shall have a min. CIL of not less than 2mcd/lx

Table 1 min. CIL vales for category 'A' studs.

Entrance Angle	Observation Angle	C.I.L. in mcd/lx		
		White	Amber	Red
0° U 5° L&R	0.3°	220	110	44
0° U 10° L&R	0.5°	120	60	24

Table 2 min. CIL vales for category 'B' studs.

Entrance Angle	cvObservation Angle	C.I.L. in mcd/lx		
		White	Amber	Red
0° U 6° L&R	0.3°	20	10	4
0° U 10° L&R	0.5°	15	7.5	3

Note:

- 4.3** The enterance angle of 0° U corresponds to the normal aspect of the reflectors when the reflecting road stud is installed in horizontal road surface.
- 4.4** The stud incorporating one or more corner cube reflectors shall be included in category 'A'. the stud incorporating one or more bi-convex reflectors shall be included in category ' B'.

5. Tests

5.1 Coefficient of luminance intensity can be measured by procedure described in ASTM 809 " Practice for Measuring Photometric characteristics" or as recommended in BS 879 part 4:1973

5.2 under test conditions, a stud shall not be considered to fail the photometric requirements if the measured C.I.L at any one position of measurements is less than the values specified in Table 1 or 2 provided that

- i) the value is not less than 80 percent of the specified minimum and
- ii) the average of the left and right measurements for the specific angle is greater than the specified minimum

6. Fixing of Reflective studs

6.1 Requirements

The enveloping profile of the head of the stud shall be smooth and the studs shall not present any sharp edges to traffic. The reflecting portion of the studs shall be free from crevices or ledges where dirt might accumulate. Marker height shall not be less than 10mm and shall not exceed 20mm. and its width should not exceed 130mm. the base of the marker shall be flat within 1.3mm. if the bottom of the marker is configured, the outer most faces of the configurations shall not deviate more than 1.3mm from the flat surface. The marker shall be fitted with two polymer shanks at appropriate places at either ends and shall be slotted along its length. The Shank Length for Each of the shanks shall not be less than 20 millimeter.

All road studs shall be legibly marked with name, trade mark or other means of identifications of the manufacturer.

6.2 Placement

The reflective marker shall be fixed to the road surface using the adhesives and the procedure recommended by the manufacturer. No nails should be used to fix the marker so that they do not pose safety hazard on the roads. Regardless of the type of adhesive used, the markers shall not be fixed if the pavement is not surface dry and on new asphalt concrete surface until the surface has been opened to traffic for period of not less than 14 hours. The portions of the Road surface to which marker is to be bonded by the adhesive shall be free of dirt, curing compound, grease, oil, moisture, loose or any other material which would adversely affect the bond of the adhesive.

The adhesive shall be placed uniformly on the Cleaned pavement surface or on the bottom of the markers in a quantity sufficient to result in complete coverage of the area of the contact of the marker surface with no voids present at a slight excess after the marker surface has been lightly pressed in place. For epoxy installations, excess adhesive around the edge of the marker, excess Adhesive on the pavement and adhesive on the exposed surfaces of the markers shall be immediately removed.

6.3 Warranty and Durability

The contractor shall obtain from the manufacturer a two year warranty for contractor held performance including stipulated retro reflectance of the reflecting panel and submit the same to the Engineer in charge. In addition a two year warranty for satisfactory infield performance of the finished road marker shall also be given by the contractor who carried out the work of fixing of reflective road markers. In case the markers are displaced, damaged, get worn out or low their reflectivity compared to stipulated standards, the contractor would be required to replace all such marker within 15 days of the intimation from the Engineer at his own cost.

7. Measurement of Payment

The measurement of reflective road markers shall be in number of different types of marker supplied and fixed.

8. Rate

The contract unit rate for reflective road marker shall be payment in full compensation for furnishing all labor, materials, tools, equipment including incidental costs necessary for carrying out the work at site conforming to the specifications complete as per approved drawings or as directed by the Engineer

Item no. 08; Flexible Median Marker : Providing and Fixing of Flexible Median Marker that are made of tough, high impact resistant, injection-molded, thermoplastic body with property of flexibility to provide high durability. The dimension of Flexible Median Marker should not exceed 18.4 cm in height(including shank height), 12.5 Cm in width, .0.65 cm in thickness and shank depth shall be 3.4 cm The body structure shall be rounded at all its corners and edges. The plastic used for molding the Flexible Median Marker should survive impact load of 5kg continuously for 750 times at room temperature. The logo of the manufacturer shall be embossed on either side of the body in the injection molding process. The Median Marker shall have flame like shaped body with, fluorescent yellow color retro- reflective sheeting of size not less than 90 Cm square, with fully reflective micro prismatic cube corners as its retro-reflective elements as per IRC 67 2012 and ASTM D4956-09 type XI specifications reflectivity values. The retro-reflective sheeting shall be one or both sides of the Flexible Median Marker and shall be edge protected with no exposed edges which will prevent edge lifting, vandalism, sheeting damage, etc. The Flexible Median Marker shall be fixed by a combination of epoxy adhesive and grouting as recommended by manufacturer and Engineer in charge..R&B SOR 2024-25 Ch -26 Item code-26167, Page No 223)

Details specification for this item :-

Material & Manufacturing:

1. Description:

Flexible Median Marker is made from a combination of tough, high impact resistant engineering thermoplastic material with U shape structure having rebound/bounce-back property. The fluorescent yellow reflective sheeting in the FMM helps to highlight the medians and increase the visibility during the night.

The product should have edge sealed Reflective sheeting for vandal proof from pilling off the sheeting for longer durability and service life.

A. **Color:** The marker body shall be produced in neutral Black color. The color of the retro-reflective element shall be Florescent Yellow.

B. Material:

The plastic body of the Flexible Median Marker shall be moulded from Flexible Thermoplastic Body.

C. Dimensions:

Height: The marker height shall be min 181mm

Width: The marker width shall be min. 120mm

Body Thickness: min 6.5mm

Shank Length: Each of the shanks shall not be less than 20 millimeter and depth shall not be less than 30mm.

2. RETROREFLECTIVE SHEETING

The Median Marker shall have rectangular shaped fluorescent yellow colored retro-reflective sheeting, conforming to ASTM D4956 -09 type XI specifications, on its surfaces.

The retro-reflective sheeting shall be on both sides of the Flexible Median Marker and shall be edge protected with no exposed edges which will prevent edge lifting, vandalism, sheeting damage, etc. The edge of sheeting should not come out easily by putting nails, sharp objects etc. The logo of the manufacturer shall be embossed on either side of the body.

The retro-reflective sheeting shall be made of retro-reflective elements that are optically stable, non-metallized, fully retro-reflective, micro-prismatic cube-corners.

Color (daytime)

The retro-reflective sheeting used in the Median Marker shall be of fluorescent yellow color.

The chromaticity coordinates (x,y) of the retro-reflective sheeting shall conform to Table II

TABLE II: Color Specification Limits¹ (Daytime)

Color	1		2		3		4	
	X	y	X	Y	X	y	X	Y
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442

Fluorescence

The minimum total daytime luminance for the fluorescent yellow colored retro-reflective sheeting, measured in terms of luminance factor (Y_T %), shall be as per the below Table III.

Table III: Daytime Luminance

Color	Minimum Total Luminance Factor (Y_T %)
Fluorescent Yellow	45%

Conformance to standard chromaticity (x, y) and luminance factor (Y %) requirements shall be determined by instrumental method in accordance with ASTM E 991.

Coefficients of Retro-reflection (R_a)

The retro-reflective sheeting used in the Median marker shall conform to ASTM D4956 Type XI specifications.

The minimum coefficients of retro-reflection for the retro-reflective sheeting, expressed in candelas per lux per square meter (cd/lux/m²), shall be as per Table IV

TABLE IV

Minimum Initial Coefficient of Retro-reflection (Ra) for retro-reflective sheeting used in Median Marker (cd/lux/m²) (Confirming to ASTM D4956 type XI specifications)

Observation Angle ² (°)	Entrance Angle ³ (°)	Fluorescent Yellow
0.2	-4	350
0.2	+30	130
0.5	-4	250
0.5	+30	90
1.0	-4	72
1.0	+30	27

²Observation Angle – The angle between the illumination axis and the observation axis.

³Entrance Angle – The angle from the illumination axis to the retro-reflector axis. The retro-reflector axis is an axis perpendicular to the retro-reflective surface.

Conformance to coefficient of retro-reflection requirements shall be determined by instrumental method in accordance with ASTM E-810 “Test Method for Coefficient of Retro-reflection of Retro-reflective Sheeting”, and per E-810 the values of 0° and 90° rotation are averaged to determine the Ra.

3 Installation

Flexible Median Marker shall be fixed by a combination of epoxy adhesive and grouting/Drilling on concrete medians or properly constructed solid medians. The Combination of proper grouting (Drill) Epoxy would help for better application and epoxy giving proper support.

4.Measurements for Payment

The payment shall be made on per Number basis.

5.Rate

The Contract unit rate shall be payment in full for the cost of application, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications

Ietm no :-9

Solar Stud:

Material and Manufacturing:

This specification covers durable, solar powered, LED illuminated raised pavement markers with dual shanks and circular 360 degree visibility designed for installation on bitumen, asphalt and concrete road surfaces. The markers are designed for installation at the edges of the road and on approach to safety hazard locations like pedestrian crossings, curves, median openings, cross drainage structures etc. The markers shall be designed to provide highly effective, long-life, night time self-illumination in active mode and retro-reflectivity in passive mode.

II. DESCRIPTION

The marker shall be produced from an engineered polymer selected for superior impact resistance and weather-ability. The top of the marker should be transparent for solar charging and light output in active mode. The base of the body shall be neutral white as specified. The marker shall incorporate a solar panel (comprising of solar cells) for converting solar energy into electricity, a storage device for storing the energy, LEDs for illumination and a design for providing 360 degree smooth illumination while enhancing the marker life. The marker also has 3M high reflective lenses for conspicuity in passive mode and dual shanks for improved road presence. These markers are intended for application directly onto pavement surfaces and shall be applied with epoxy resin adhesives designed for use with raised pavement markers and as supplied by the marker manufacturer separately.

III. REQUIREMENTS

The marker shall meet the following specified requirements:

Color: The top of the marker body shall be transparent; the base shall be produced in neutral white as specified. The color of the blinking light shall be red or yellow (amber) as specified.

Dimensions: The typical dimensions of the marker shall be:

Height: 65 ± 2 mm

Minimum Diameter: 100 ± 5 mm

Weight: The typical weight of the marker shall be 375 ± 25 g.

Test Conditions: Unless otherwise specified, all test specimens shall be conditioned for 24 hours at 23° C ± 1° C and 50% ± 4% R.H. before testing.

Self Illumination: At fully charged state, the minimum light output measurements at any point of the illuminated part of the marker should be 15 Cd/m² under the following test conditions

- ☐ Equipment: Konica Minolta Luminance Meter LS 110
- ☐ Height of the equipment from the light source: 0.305 m
- ☐ Horizontal distance between the light source and the equipment: 1.042 m

- ☐ Area: Total Area covered
- ☐ Dark room conditions
- ☐ Tested values are for red colored LED only
- ☐ Visibility Distance: Long visibility from a Distance of more than 800m

Activation: The marker has a mechanism for initial activation which ensures longer life during storage. The sleep current during the sleep mode is less than 20 microamperes.

Blinking Frequency: The typical blinking frequency of the illuminated marker shall be 1Hz as specified.

Temperature Resistance: The marker should perform in the temperature range of 0 C to 70 C.

Ingress Protection: The body of the marker should be resistant to dust and water ingress as per IP 65 standards.

Compression Strength: When tested in accordance with ASTM D4280, the marker shall support a load of 20000 kg without breakage or significant deformation.

Warranty: The Solar studs life shall be not less than 3 years

Measurements for Payment

The payment shall be made on per Number basis.

Rate

The Contract unit rate shall be payment in full for the cost of application, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications

Item no :-10

Standard Delineator consisting of minimum retro reflective unit exposed area of 330 cm² white color, full cube corner micro prismatic non-metallic retro reflective sheeting on each side conforming with IRC 67 2012 and meeting the coefficient of retro reflection values as per ASTM D 4956 Type XI table specification. The delineator shall be painted with powder coat of minimum 40 microns thickness, on top of which retro reflective sheeting shall be pasted on both sides. The structure shall be manufactured in roll forming process and shall have height not less than 800 mm above the ground, width not less than 100 mm and shall extend not more than 300mm below the ground while being installed. height of sheeting should be minimum 150mm whereas width of sheeting should not be less than 75mm (should be placed every alternative 15cm). The front and back faces of the delineator should be curved with a radius of not more than 200 mm and with delta angle (or central angle of curve) lying between 20o and 30o, to increase the visibility of the delineator for vehicles moving in continuous curves. The delineator shall have grooves across the length to make the reflective sheets vandal-proof. The delineator is meant for application on gaps in median, traffic islands, dangerous bends, roundabouts, narrow bridges etc. or as desired by site engineer.
R&B SOR 2024-25 Ch -26 Item code-26166

Details specification for this item :-

Description

Standard Delineators are retroreflective devices mounted above the roadway surface and along the side of the carriageway in a series, to indicate the alignment of the roadway. Delineators shall consist of retroreflective strips,

capable of clearly retro-reflecting light under normal atmospheric conditions from 300m (1,000 ft) when illuminated by the high beams of standard automobile lights. The Standard Delineator shall have an elliptical curved design, with grooves across the length of the delineator as an embodiment that helps in sufficient protection of the edge of the reflective sheets from vandalism. Moreover, the continuous curve design of the profile allows reflective sheeting to reflect in a wider entrance angle thereby increasing visibility.

Material

The Delineator shall be made up of Mild Steel with desired thickness and should be manufactured in Roll forming process. The metal shall have pure polyester powder coating with the minimum thickness of not less than 40 micron for protection against corrosion. Retro reflective sheeting should be pasted on both sides such that it provides better visibility for vehicles moving in continuous curves at various conditions such as high and low entrance angles.

Installation

The Standard Delineator shall be fixed to the ground by inserting the root of the delineator up to 300mm below the ground. This portion of the delineator is to be filled with concrete grade, as per the instructions of engineer in charge, along with anchoring bolt.

Requirements

1. Optical Performance

The Delineator should consist of top retroreflective unit consisting of white color micro prismatic non-metallic retroreflective sheeting conforming with ASTM D4956 type XI standards of minimum exposed area 330 cm² on one side ie. height of sheeting should be minimum 150mm whereas width of sheeting should not be less than 75mm (should be placed every alternative 15cm) and should have same exposed area for the other side if the delineator indicated is two-sided reflectivity. Retro reflectivity should meet the coefficient of retroreflection as per the below Table.

Observation Angle ⁰	0.2		0.5		1	
Entrance Angle ⁰	-4	30	-4	30	-4	30
Coefficient of retroreflection for White color	580	220	420	150	120	45

Supplementary requirement for observation angles of 0.1⁰ may be applicable as per IRC 67/ASTM D 4956

2. Color

The color of retroreflective sheeting shall be white with the whiteness index (CapY) not less than 27.

3. Dimensions

The height of the Standard Delineator should not be less than 800 mm above the ground after installation. The width of delineator should not be less than 100 mm. The front and back faces of delineator should be curved with a radius of not more than 200 mm and with delta angle (or central angle of curve) lying between 20° and 30°, to increase the visibility for vehicles moving in continuous curves. It should have a drilling hole of 12 mm for fixing the anchor bolt. The center of this drilling hole should be 150 mm from the base of the delineator. The tail of delineator inside the ground should not be more than 300mm.

4. Measurements for Payment

The payment shall be made on **per Number** basis.

5. Rate

The Contract unit rate shall be payment in full for the cost of application, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications

Item 11: - Providing and Fixing 4 mm Aluminium Composite Materials (ACM) Sheet As Per IRC 67/2022.

Item 12:- Providing and Fixing Any Colour Class -B Type -4 Retro Reflective Sheeting As Per IRC 67/2022.

Item 13:-Providing and Fixing Any Colour Class -C Type -11 Retro Reflective Sheeting As Per IRC 67/2022.

- Detail Specification of Item no. ११, १२ and १३ is given below:-



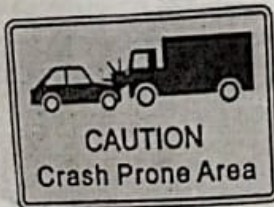
Prohibitory
Regulation



Operational
Control



Facility
Information



CAUTION
Crash Prone Area

IRC:67-2022

CODE OF PRACTICE FOR ROAD SIGNS

(Fourth Revision)



INDIAN ROADS CONGRESS
2022

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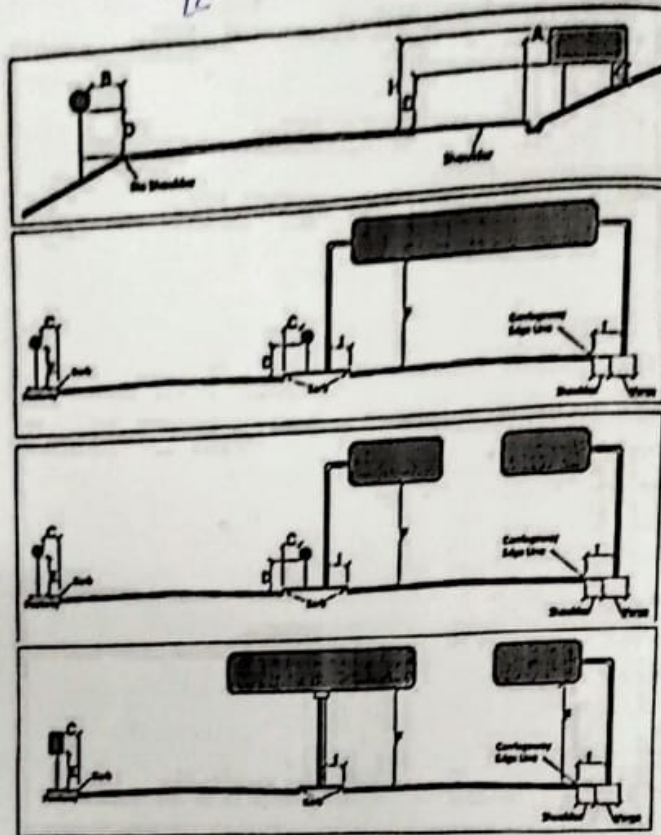


Fig. 4.1 Typical Siting of Signs with respect to Carriageway (Heights and Clearances)
(Refer Table 4.1 for values)

5. ORIENTATION OF SIGNS

5.1 The signs unless otherwise stated shall normally be placed at right angles to the line of travel of the approaching traffic. Signs relating to parking, however, should be fixed at an angle (approximately) 15° to the carriageway so as to give better visibility.

5.2 Where light reflection from the sign face is encountered to such an extent as to reduce legibility, the sign should be turned slightly away from the road as shown in Fig. 5.1. On horizontal curves, the sign should not be fixed normal to the carriageway, but the angle of placement should be determined with regard to the course of the approaching traffic.

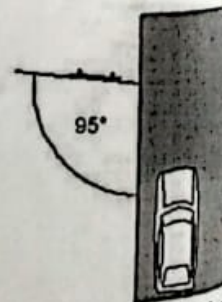


Fig. 5.1 Sign Orientation with respect to Carriageway

- 5.3 Sign faces are normally vertical, but on gradients it may be desirable to tilt a sign forward or backward from the vertical to make it normal to the line of sight and improve the viewing angle.

6. MATERIAL FOR SIGNS

The various materials and fabrication of road signs shall conform to the following requirements:

- 6.1 **Concrete:** Concrete shall be of M25 grade for foundation.
- 6.2 **Reinforcing Steel:** Reinforcing steel shall conform to the requirements of Indian Standards (IS 1786) unless otherwise specified.
- 6.3 **Bolts, Nuts and Washers:** High strength bolts shall conform to IS 1367 whereas precision bolts, nuts, etc. shall conform to IS 1364.
- 6.4 **Plates and Supports:** Plates and support sections for the sign posts shall conform to IS 226 and IS 2062 or any other stated IS specification. Concrete structures shall not be used for plates and supports.
- 6.5 **Substrate:** The substrate shall be either Aluminium sheeting or Aluminium Composite Material (ACM) conforming to the following subsections only.

6.5.1 Aluminium

Aluminium sheets used for sign boards shall be of smooth, hard and corrosion resistant Aluminium alloy conforming to IS 736 - Material Designation 24345.

6.5.2 Aluminium Composite Materials (ACM)

ACM sheets used for sign boards is a sandwiched construction with a thermoplastic core of 'Low Density Polyethylene' (LDPE) between two thick skins/sheets of Aluminium with overall thickness of 4 mm and 3 mm, and Aluminium skin thickness of 0.4 - 0.5 mm and 0.25 - 0.3 mm respectively on both sides. The retro reflective sheeting must be applied on the top surface with aluminium surface with recommended surface preparation from sheeting manufacturer. A fluorocarbon coating may be applied over the exposed surface of aluminium to ensure corrosion resistant and weatherability and shall conform to relevant American Society for Testing and Materials (ASTM). The mechanical properties of 4 mm and 3 mm ACM and that of its Aluminium skin shall conform to the requirement given in Table 6.1, when tested in accordance with the test methods mentioned against each of them.

6.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5 mm thick with Aluminium and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2 mm thick with Aluminium and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

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All overhead signs made with Aluminum Composite Material shall be minimum 4 mm thick and shall withstand wind and other loads without deformation.

Table 6.1 Specifications for Aluminum Composite Material (ACM)

Table 6.1 Specifications				
S. No.	Description	Specification for 4 mm		Specification for 3 mm
		Standard Test	Acceptable Value	Acceptable Value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting (Drum Peel Test)	ASTM D 903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile Strength	ASTM E 638	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E 638	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E 638	Min. 6 %	Min. 5 %
5	Flexural Strength	ASTM C 393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch Shear Test	ASTM D 732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminum Skin			
1	Tensile Strength (Rm)	ASTM E 8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of Elasticity	ASTM E 8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E 8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E 8	Min. 110 N/mm ²	Min. 110 N/mm ²

6.7 Retro Reflective Sheeting

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested as per ASTM D 4956 for coefficient of retro reflection, daytime colour, colour fastness and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, night time colour, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government Laboratory/Institute by the manufacturer of the sheeting and in case the certificate is obtained from international agency, it should also be obtained from Indian agency within 3 years of launching of product by the manufacturer including actual outdoor weathering in Indian conditions. Alternatively, a certificate conforming to ASTM D 4956 specification or artificial accelerated weathering requirements from a reputed laboratory in India can be accepted provisionally. In such a situation, the Employer/Client, if so desires, could seek for a performance guarantee which would be released after the receipt of certificate meeting the requirement of three years outdoor weathering of the sheeting. Retro reflective sheeting is divided into three classes as follows:

CLASS A Sheeting: - Engineering and Super Engineering Grade Sheeting as per ASTM D 4956 Type I and II.

CLASS B Sheeting: - High Intensity and High Intensity Prismatic Grade Sheeting as per ASTM D 4956 Type III and IV.

CLASS C Sheeting: - All Micro Prismatic Grade Sheeting as per ASTM D 4956 Type VIII, IX and XI.

6.7.1 Selection of Sheeting

The performance characteristics of sheeting Type I to Type XI used for road signs are presented in Table 6.3 to Table 6.9. The definition of key words in understanding the performance characteristics are given below.

Retro-reflection means the reflection of light which is returned in directions close to the direction from which it came and this property being maintained even over wide variations of the direction of the incident radiation:

Observation angle (α) is the angle between the illumination axis and the observation axis as shown in Fig. 6.1.

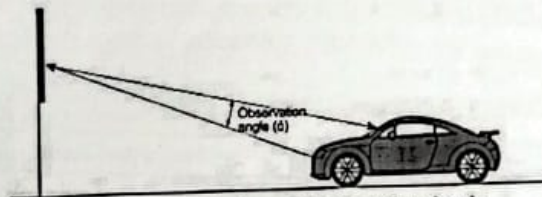


Fig. 6.1 Description of Observation Angle

Entrance angle (β) means the angle from the illumination axis to the reference axis. The reference axis is an axis perpendicular to the retro-reflective surface as shown in Fig. 6.2.

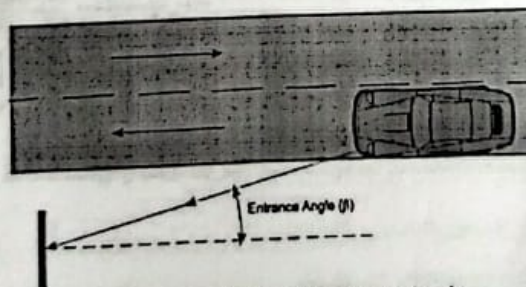


Fig. 6.2 Description of Entrance Angle

Coefficient of retro-reflection (R_r) is obtained from the luminous intensity (I) of the retro-reflective area in the direction of observation and the illuminance (E_e) on the retro-reflective plane at right angles to the direction of the incident light and the illuminated plane sample surface A as given in Eq. 6.1.

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$$R_A = 1/E_v \cdot A$$

where: R_A is coefficient of retro-reflection expressed in candela per lux per square meter (cd.lx⁻¹.m⁻²).

Though the sheeting as per ASTM classification are available from Type I to Type XI, a "higher" type of sheeting used in the ASTM need not necessarily imply that it is better than a "lower" type sheeting, rather it meets different performance characteristics. Each type of sheeting suits the situation encountered by road users in viewing the signs on the particular road. For example, sheeting with high coefficient of retro reflection at small observation angle will give better performance for driver's viewing the sign from long distances. Similarly, signs with wide observation angle give good performance for drivers encountering situations to observe the signs at short range distances. Thus, Class C Micro prismatic sheeting shall be preferred to the major category of roads like Expressways, National/State Highways and Urban Roads. Moreover, Type XI sheeting with observation angle of up to 1° shall be preferred while choosing Class C grade sheeting applications as it offers good visibility from short and medium range distances. Type IV micro prismatic sheeting may be used for delineator posts.

Table 6.2 presents a general guideline for selection of sheeting considering the performance characteristics of each type of sheeting for different categories of roads and also on economic consideration and visibility requirements in Indian context. However, the choice for selection of type of sheeting would rest with the client.

Table 6.2 Suggested Guidelines for Usage of Retro-Reflective Sheeting

Class of Sheeting	Type of Sheeting (ASTM)	Category of Road				
		Expressway	National / State Highway	Major District Roads	Other District Roads and Village Roads	Urban/ City Roads
CLASS A	Type I	No	No	No	Yes	No
CLASS B	Type IV	No	No [#]	Yes	Yes	No [#]
CLASS C	Type IX	No	No	Yes [§]	No	Yes
	Type XI	Yes	Yes	Yes [§]	No	Yes

- for Work Zone, Type IV can be used

§ - Optional: can be used based on site requirements

6.7.2 Class A (Engineering Grade Sheeting)

6.7.2.1 Type I Engineering Grade Sheeting

This sheeting shall be of enclosed lens glass bead type consisting of microscopic lens elements or micropismatic retroreflective elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection determined in accordance with ASTM D 4956 which is indicated in Table 6.3.

Table 6.3 Acceptable Minimum Co-efficient of Retro-Reflection for Type I Engineering Grade Sheeting (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	-4°	70	50	25	9.0	14	4.0	1.0
0.2°	+30°	30	22	7.0	3.5	6.0	1.7	0.3
0.5°	-4°	30	25	13	4.5	7.5	2.0	0.3
0.5°	+30°	15	13	4.0	2.2	3.0	0.8	0.2

(Source: ASTM D 4956)

At the end of 5 years, the sheeting shall retain at least 50 percent of the retro-reflectance values given in Table 6.3.

6.7.2.2 Type II Super Engineering Grade Sheeting

This sheeting shall be of enclosed lens glass bead type consisting of microscopic lens elements or microprismatic retroreflective elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.4.

Table 6.4 Acceptable Minimum Coefficient of Retro-Reflection for Type II Super Engineering Grade Sheeting (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.2°	-4°	140	100	60	30	30	10	5
0.2°	+30°	60	36	22	10	12	4	2
0.5°	-4°	50	33	20	9	10	3	2
0.5°	+30°	28	20	12	6	6	2	1

(Source: ASTM D 4956)

At the end of 5 years, the sheeting shall retain at least 50 percent of the retro-reflectance values given in Table 6.4.

6.7.3 Class B (High Intensity Grade Sheeting)

6.7.3.1 Type III High Intensity Grade

This high intensity retro-reflective sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements or microprismatic retroreflective elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.5.

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At the end of 7 years, the sheeting shall retain at least 80 percent of the retro-reflectance values given in Table 6.5.

Table 6.5 Acceptable Minimum Coefficient of Retro-Reflection for Type III High Intensity Grade Sheeting^A (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1°	-4°	300	200	120	54	54	24	14
0.1°	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

A Minimum Coefficient of Retro reflection (R_s) ($\text{cd.lx}^{-1}.\text{m}^2$). (Source: ASTM D 4956)

B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

6.7.3.2 Type IV High Intensity Micro-Prismatic Grade Sheeting (HIP)

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.6.

At the end of 7 years, the sheeting shall retain at least 80 percent of the retro-reflectance values given in Table 6.6.

Table 6.6 Acceptable Minimum Coefficient of Retro-Reflection for Type IV High Intensity Micro-Prismatic Grade Sheeting^A (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
-0.1°	-4°	500	380	200	70	90	42	25
0.1°	+30°	240	175	94	32	42	20	12
0.2°	-4°	360	270	145	50	65	30	18
0.2°	+30°	170	135	68	25	30	14	8.5
0.5°	-4°	150	110	60	21	27	13	7.5
0.5°	+30°	72	54	28	10	13	6	3.5

Minimum Coefficient of Retro-reflection (R_r) ($\text{cd.lx}^{-1}.\text{m}^{-2}$). (Source: ASTM D 4956)

- A
B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

6.7.4 Class C (Micro Prismatic Grade Sheetting)

6.7.4.1 Type VIII Micro Prismatic Grade Sheetting

Retro-reflective sheetting is typically manufactured as a cube corner. The reflective sheetting shall be retro-reflective sheetting made of micro prismatic retro-reflective material. The retro-reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.7.

At the end of 10 years, the sheetting used shall retain at least 80 percent of the retro-reflectance values presented in Table 6.7.

6.7.4.2 Type IX Micro Prismatic Grade Sheetting

Retro-reflective sheetting is typically manufactured as a cube corner. The reflective sheetting shall be retro-reflective sheetting made of micro prismatic retro-reflective material. The retro-reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.8.

At the end of 10 years, the sheetting shall retain at least 80 percent of the retro-reflectance values given in Table 6.8.

Table 6.7 Acceptable Minimum Coefficient of Retro-Reflection for Type VIII Prismatic Grade Sheetting^A (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1°	-4°	1000	750	375	100	150	45	30	800	600	300
0.1°	+30°	460	345	175	46	69	21	14	370	280	135
0.2°	-4°	700	525	265	70	105	32	21	560	420	210
0.2°	+30°	325	245	120	33	49	15	10	260	200	95
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35

- A Minimum Co-efficient of Retro-reflection (R_r) ($\text{cd.lx}^{-1}.\text{m}^{-2}$). (Source: ASTM D 4956)
B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

Table 6.8 Acceptable Minimum Coefficient of Retro-Reflection for Type IX Prismatic Grade Sheet^a (Candela Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange
0.1°	4°	660	500	250	66	130	30	530	400	250
0.1°	+30°	370	280	140	37	74	17	300	220	140
0.2°	4°	380	285	145	38	76	17	300	230	145
0.2°	+30°	215	162	82	22	43	10	170	130	82
0.5°	4°	240	180	90	24	48	11	190	145	90
0.5°	+30°	135	100	50	14	27	6	110	81	50
1.0°	4°	80	60	30	8	16	3.6	64	48	30
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	17

A Minimum Coefficient of Retro-Reflection (R_r) ($\text{cd.lx}^{-1}.\text{m}^2$). (Source: ASTM D 4956)

B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

6.7.4.3 Type XI Micro Prismatic Grade Sheet

Retro-reflective sheeting is typically manufactured using a full cube corner technology. The reflective sheeting shall be retro-reflective sheeting made of micro prismatic retro-reflective material. The retro-reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956) as indicated in Table 6.9.

Table 6.9 Acceptable Minimum Coefficient of Retro-Reflection for Type XI Prismatic Grade Sheet^a (Candela per Lux per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Florescent Yellow-Green	Florescent Yellow	Florescent Orange
0.1°	4°	830	620	290	83	125	37	25	660	500	250
0.1°	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

29
 A Minimum Coefficient of Retro-reflection (R_r) ($\text{cd.lx}^{-1}.\text{m}^2$). (Source: ASTM D 4956)

B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order.

At the end of 10 years, the sheeting shall retain at least 80 percent of the retro-reflectance value given in Table 6.9.

6.7.5 Adhesives

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

6.7.6 Fabrication

Surface to be reflectorized shall be effectively prepared to receive the retro-reflective sheeting. The aluminum sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. Signs with a side dimension up to 1200 mm shall not have any joints (splices) in the base retro reflective sheeting and in the substrate. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

6.8 Messages/Borders

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or cut out from durable transparent overlay or cut-out from the same type of reflective sheeting or digitally printed for the cautionary and mandatory sign boards on top of the base retro reflective sheeting which should be covering the entire sign facia (end to end) of the substrate. Either screen printing or digitally printing shall be processed and finished with materials in a manner specified by the sheeting manufacturer. In the case of informative sign boards (including tourism related sign boards), the messages (legends, letters, numerals etc.) and borders shall be cut-out from durable transparent overlay film or cut-out from the same reflective sheeting or digitally

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printed. Such cut-outs shall be made from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. Whenever transparent overlay film is used for making any type of cut-out, the coloured portion of sign shall have coefficient of reflectivity not less than the reflectivity of the sheeting normally used which are given in Tables 6.3 to 6.9. Cut-out materials and borders, wherever used, shall be either made out of retro-reflective sheeting or made of durable transparent overlay except those in black which shall be of opaque in the durable transparent overlay.

In the case of screen printed transparent coloured areas on white sheeting, the coefficient of retro reflection shall not be less than 50 percent of the values of corresponding colour given in Tables 6.3 to 6.9. In the case of digital printing, the signs shall be manufactured using a system of matched components of reflective sheeting and overlay films and digital inks manufactured and supplied by the reflective sheeting manufacturer. The digital printer and digital ink shall be approved by the reflective sheeting manufacturer. Digitally printed traffic colour (red, blue, yellow, orange and brown) areas on white sheeting shall not be having less than 70 percent of the value of the coefficient of retro reflection established for its colour and type of sheeting given in Table 6.3 to 6.9.

Initial colour shall meet the daytime and nighttime colour limits as defined in the effective version of ASTM D 4956. Printed traffic colours shall also meet the accelerated outdoor weathering colour fastness requirements as per ASTM D 4956. Digitally printed black copy shall remain sufficiently opaque for its intended use for the warranty period of the base sheeting. Digital printing of custom colours shall have documented sheeting manufacturer warranty, stating that custom colours do not excessively fade, discolour, crack, craze, peel, blister or lose reflectivity such that the signs become functionally unsuitable for their intended purpose during the warranty period of the base sheet. Finished signs shall have an Ultra Violet (UV) protective clear overcoat applied to the entire face of the sign supplied by the reflective sheeting manufacturer. Overlays and digital inks shall be part of a matched component system as recommended by the reflective sheeting manufacturer. Completed printed surface shall be free of bubbles, blemishes, streaks or spotted areas. In the case of Chevron Signs and Object Hazard Markers, full surface shall be covered with retro reflective sheeting and the patterns shall be made with either black overlay film or screen printing or digital printing.

6.9 Warranty and Durability

The Contractor shall obtain from the manufacturer of the reflective sheeting a ten year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting for micro-prismatic Class C grade sheeting, seven years for Class B grade sheeting and five years for Class A grade sheeting and submit the same to the Engineer in charge. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro-reflective sheeting. Warranty document shall be in original having a unique number, date and shall be addressed to the engineer in charge with the project details including details of the sign boards installed. Warranty issued by any party other than the sheeting manufacturer.

all not be accepted. Contractor/supplier should furnish the lot numbers and certification that signs and materials supplied against the assigned work meets all the stipulated requirements and carry the stipulated warranty and that the contractor/supplier is the authorized converter of particular sheeting. As a part of source approval (to assure the quality of product prior to supply), contractor shall obtain from the manufacturer of sheeting a prequalification warranty certificate stating that the material they are offering will have the warranty as mentioned above and the certificate shall be submitted to the Engineer in charge. In the case of digitally printed sign boards, the coefficient of retro reflection after the stipulated warranty period shall be minimum percent of the initial value of the printed sign as per Clause 6.8. Match component system warranty for the components like retro-reflective sheeting, overlay films and digital inks shall be provided by the manufacturer.

7. POSTS AND MOUNTINGS FOR SIGNS

1 The traffic signs shall be mounted on support posts, which shall be made of either Mild Steel (MS) or Galvanized Iron (GI) pipes conforming to IS 1239, Circular Hollow Section conforming to IS 1161, Rectangular Hollow Section conforming to IS 4923 or Square Hollow Section conforming to IS 3589. In the case of signs supported on two or more posts, if necessary, bracing may also be provided. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Sign post/support end(s) shall be firmly fixed to the ground by means of properly designed concrete foundation. The work of foundation shall conform to relevant specifications.

2 All components of signs and supports including all nuts and bolts, other than the reflective portion of GI posts shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint or powder coating. Any part of mild steel (MS) post below ground shall be painted with three coats of redoxide paint.

3 Except in the case of railway level crossing signs (for which the colour scheme is given in Section 15.71) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black.

4 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

5 For overhead signs, the support system should be properly designed based on sound engineering principles, to safely sustain the dead load, live load and wind load on the completed sign system. For this purpose, the overhead signs shall be designed to withstand a wind loading of 150 kg/m² normal to the face of the sign and 30 kg/m² transverse to the face of the sign. In addition to the dead load of the structure, walkway loading of 250 kg concentrated live load shall also be considered for the design of the overhead sign structure.

Item No. 14 :- Providing & fixing M.S. Grills of required pattern, steel work, welded in built up sections framed work including cutting, hoisting, fixing in position and applying a priming coat of red lead paint. (A) In beams and joists, channels angles Tees , flats , with connecting plates or angle cleats as in main and cross beams. Hip and jack rafters, purlins connected to common rafters and the like (R&B SOR 24-25/P.No.115/ item no.11.4/Item Code .11002AA ch.11) (Upto 10 ton) (for L-shape or verticle bollard)

Item No.15:-STOP Sign :-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 cms Octagone as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type- 11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

1. Material & Manufacturing:

1.1 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.2 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.2.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.2.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.2.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.2.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.2.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as

specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.2.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

- 1.2.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.3 Traffic signs having Retro Reflective Sheeting

1.3.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.3.2 High Intensity Grade Sheeting

1.3.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0

0.5°	+30°	65	45	25	10	10	5.0	3.5
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^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow - Green	Yellow	Orange Fluorescent	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
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0.1° ^B	-4°	660	500	250	66	130	30	530	400	200
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110
0.2°	-4°	380	285	145	38	76	17	300	230	115
0.2°	+30°	215	162	82	22	43	10	170	130	65
0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36

1.0°	+30°	45	34	16	5	7	2	1	36	27	14
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^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from $1/6$ to $1/5$ of the letter 'x' size. The size of the initial uppercase letter shall be $1-1/3$ times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item No 16:-

Cautionary Warning Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor.

2. Material & Manufacturing:

1.4 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.5 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.5.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.5.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.5.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.5.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.5.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

SI No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.5.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.5.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.6 Traffic signs having Retro Reflective Sheeting

1.6.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.6.2 High Intensity Grade Sheeting

1.6.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.6.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

**Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Orange Fluorescent	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Orange Fluorescent	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	

0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y

White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item No:- 17 Regulatory / Mandatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 60 cms Dia Circle as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60

Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

3. Material & Manufacturing:

1.7 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.8 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.8.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.8.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.8.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.8.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.8.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel	ASTM D903	Min. 4 N/mm	Min. 4 N/mm

	Test)			
2	Tensile strength	ASTM E8	<i>Min. 40 N/mm²</i>	<i>Min. 30 N/mm²</i>
3	0.2% Proof Stress	ASTM E8	<i>Min. 34 N/mm²</i>	<i>Min. 34 N/mm²</i>
4	Elongation	ASTM E8	<i>Min. 6 %</i>	<i>Min. 5 %</i>
5	Flexural strength	ASTM C393	<i>Min. 130 N/mm²</i>	<i>Min. 120 N/mm²</i>
6	Shear strength with Punch shear test	ASTM D732	<i>Min. 18 N/mm²</i>	<i>Min. 18 N/mm²</i>
B	<i>Properties of Aluminium Skin</i>			
1	Tensile strength (Rm)	ASTM E8	<i>Min. 150 N/mm²</i>	<i>Min. 130 N/mm²</i>
2	Modulus of elasticity	ASTM E8	<i>Min. 70,000 N/mm²</i>	<i>Min. 70,000 N/mm²</i>
3	Elongation	ASTM E8	<i>A₅₀ Min. 2%</i>	<i>A₅₀ Min. 2%</i>
4	0.2 % Proof Stress	ASTM E8	<i>Min. 110 N/mm²</i>	<i>Min. 110 N/mm²</i>

1.8.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.8.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.9 Traffic signs having Retro Reflective Sheeting

1.9.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with

encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.9.2 High Intensity Grade Sheeting

1.9.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.9.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow - Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow - Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	

0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35
------	------	-----	----	----	----	----	---	-----	----	----	----

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap

and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity

for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informatory and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540

Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16

80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against

the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no:-18 Facility Informatory Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 80 x 60 cms rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor.

4. Material & Manufacturing:

1.10 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.11 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.11.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.11.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.11.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.11.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.11.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130

				<i>N/mm²</i>
2	Modulus of elasticity	ASTM E8	<i>Min. 70,000 N/mm²</i>	<i>Min. 70,000 N/mm²</i>
3	Elongation	ASTM E8	<i>A₅₀ Min. 2%</i>	<i>A50 Min. 2%</i>
4	0.2 % Proof Stress	ASTM E8	<i>Min. 110 N/mm²</i>	<i>Min. 110 N/mm²</i>

1.11.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.11.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.12 Traffic signs having Retro Reflective Sheeting

1.12.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.12.2 High Intensity Grade Sheeting

1.12.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.12.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Fluorescent	Orange Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	300
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	135
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	210
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	95
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	75
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	35

^A Minimum Coefficient of Retro reflection (R_A) (cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Flourescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250

0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and

borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all

directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in “NO PARKING” and “NO STOPPING” signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no 19:- Parking Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size size 60 x 60cms. square plus 60 x 20cms rectangular additional plate as as per the design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

5. Material & Manufacturing:

1.13 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.14 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.14.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.14.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.14.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.14.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.14.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material

Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110

				N/mm ²
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1.14.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.14.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.15 Traffic signs having Retro Reflective Sheeting

1.15.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.15.2 High Intensity Grade Sheeting

1.15.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10

0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) (cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.15.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Flourescent yellow-Green	Flourescent yellow	Flourescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66

0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informatory and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made

out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no :-20 Place Identification Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 150x90 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

Item no :-21

Hazard Marker Sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 90x30 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 1.8mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

6. Material & Manufacturing:

1.16 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.17 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.17.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.17.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.17.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.17.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.17.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000

				<i>N/mm²</i>
3	Elongation	ASTM E8	A ₅₀ Min. 2%	<i>A50 Min. 2%</i>
4	0.2 % Proof Stress	ASTM E8	<i>Min. 110 N/mm²</i>	<i>Min. 110 N/mm²</i>

1.17.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.17.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.18 Traffic signs having Retro Reflective Sheeting

1.18.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.18.2 High Intensity Grade Sheeting

1.18.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
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0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.18.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A**(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Flourescent yellow-Green	Flourescent yellow	Flourescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100

0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be

bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in “NO PARKING” and “NO STOPPING” signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no :-22

Give Way Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

7. Material & Manufacturing:

1.19 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.20 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.20.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.20.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.20.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.20.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.20.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be

sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.20.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.20.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.21 Traffic signs having Retro Reflective Sheeting

1.21.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.21.2 High Intensity Grade Sheeting

1.21.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12

0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.21.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Flourescent yellow-Green	Flourescent yellow	Flourescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66

0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informatory and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made

out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item No.23:- Direction (Junction) Sign :-Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 244x122 cms. rectangular as per design of IRC-67-2012. Pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

8. Material & Manufacturing:

1.22 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.23 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.23.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.23.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.23.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.23.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.23.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

SI No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.23.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.23.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.24 Traffic signs having Retro Reflective Sheeting

1.24.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.24.2 High Intensity Grade Sheeting

1.24.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.24.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

**Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Green - Yellow	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	

0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y

White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage , flexibility, liner removal , adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no 24 :- Distance Informatoru / Destination Sign:-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x120 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4.0mtr long (2 Nos.) stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction

of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

Item no 25:-

Sign board per Square Meter :- Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 1 meter x 1 meter as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 4 mtr long stand post (2 Nos.) of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with best quality epoxy coatings in black and white bands. The details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

9. Material & Manufacturing:

1.25 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.26 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.26.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.26.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.26.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.26.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.26.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

<i>Sl No.</i>	<i>Description</i>	<i>Specification for 4mm</i>		<i>Specification for 3mm</i>
		<i>Standard test</i>	<i>Acceptable value</i>	<i>Acceptable value</i>
A	<i>Mechanical Properties of ACM</i>			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	<i>Properties of Aluminium Skin</i>			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.26.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with

Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

- 1.26.7** In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.27 Traffic signs having Retro Reflective Sheeting

1.27.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.27.2 High Intensity Grade Sheeting

1.27.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.27.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Green - Yellow	Yellow	Fluorescent Orange	Fluorescent Yellow
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	

0.2°	+30°	215	162	82	22	43	10	170	130	65
0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Flourescent yellow-Green	Flourescent yellow	Flourescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values,

of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A

Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage , flexibility, liner removal , adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

0.2°	+30°	170	135	68	25	30	14	8.5
0.5°	-4°	150	110	60	21	27	13	7.5
0.5°	+30°	72	54	28	10	13	6	3.5

Rate shall be for a unit of one square meter.

Item No 26:- Men at work (Folding) sign :-Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 60x60 x 60cm equilateral triangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription/ numerals for each board shall be as per the instruction of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

Item no :-27 Tree Guard sign :-Providing & fixing sign board made out of 2mm aluminium sheet / 3mm ACP (Aluminum composite Panel) , size 30cms diameter circle, pretreated with phosphating process and acid etching, painted with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with retro reflective sheeting as per latest M.O.S.T. specifications. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

10. Material & Manufacturing:

1.28 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.29 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.29.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.29.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.29.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.29.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.29.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as

specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

Sl No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.29.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.29.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.30 Traffic signs having Retro Reflective Sheeting

1.30.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.30.2 High Intensity Grade Sheeting

1.30.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0

0.5°	+30°	65	45	25	10	10	5.0	3.5
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^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.30.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Green - Yellow-	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Orange Fluorescent	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Yellow-Green	Fluorescent	Orange	Fluorescent
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0.1° ^B	-4°	660	500	250	66	130	30	530	400	200
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110
0.2°	-4°	380	285	145	38	76	17	300	230	115
0.2°	+30°	215	162	82	22	43	10	170	130	65
0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Observation Angle	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36

1.0°	+30°	45	34	16	5	7	2	1	36	27	14
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^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informatory and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

ITEM No:28 Route Marker sign :-

Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 60x45 cm rectangular plus 30x25cm additional plate as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

ITEM No:29 Danger Plate :-

Providing & fixing sign board made out of 2.0 mm aluminium sheet / 4 mm ACP (aluminum Composite Panel) , size 30cms diameter circle, pretreated with phosphating process and acid etching, painted with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with retro reflective sheeting as per latest M.O.S.T. specifications. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class- C Type-11 Retro Reflective sheeting.

ITEM No:30 Railway crossing sign:-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 90 x 90 x 90 cms. equilateral triangle plus 90x30cm additional plate as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro-reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.6mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

ITEM No:31 Four (Two) Lane Ahead Sign :-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 120x120 cms. square plus 120x60 cm additional plate as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 4 mtr long stand post (2 Nos.) of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm;

painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

ITEM No:32 Diversion Ahead Sign :-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. rectangular as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ; reflectorised with Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; 3.1 mtr long stand post (2 Nos.) of 50 x 50 x 5mm / 50NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with best quality epoxy coatings in black and white bends. The details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60 Cms. for each leg, including excavation, curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

ITEM No:33 Kerb guard sign board (small) :-

Providing & Fixing sign boards made out of 2mm aluminium sheet, size 240 x 30 cms in U shape; as per the attached drawing pre treated with phosphating process & acid etching. coated with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications; stand post and frame fabricated from iron angle of 50x50x5mm, 10mm sq. bar as required, painted with best quality epoxy coating the fixing at site shall be in 1:2:4 CC block of size 45 x 45x 60cms for each leg, including excavation curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

Item no 34:- Kerb guard sign board (Big):-

Providing & Fixing sign boards made out of 2mm aluminium sheet, size 732 x 30 cms in U shape; as per the attached drawing pretreated with phosphating process & acid etching. coated with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with Micro Prismatic Grade retro reflective sheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T. Specifications ; Stand post and frame fabricated from iron angle of 50 x50 x 5mm, 10mm sq. bar as required, painted with best quality epoxy coating the fixing at site shall be in 1:2:4 CC block of size 45 x 45x 60cms for each leg, including excavation curing etc. complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

ITEM No:35 Around the Island / road Direction Sign board (Big):-

Providing and fixing sign boards made out of 2mm aluminium sheet / 4mm ACP (Aluminum composite Panel); size 180x60 cms. as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol for each board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting.

Item no 36 Around the Island / road Direction Sign board (Small) :-

Providing and fixing sign boards made out of 2.0 mm aluminium sheet / 4 mm ACP (Aluminum composite Panel); size 60x60 cms. as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 35 x 35 x 3mm; painted with bestquality epoxy coatings in black and white bends. The details of symbol foreach board shall be as per theinstruction of engineer in charge. The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

Item no 37:-

AFP (Aluminum Backed Flexible Prismatic):

Description

The Aluminum-backed flexible prismatic reflective sheeting specified herein is intended for manual application to moderately rough or porous concrete, wood or masonry surfaces for increased nighttime visibility.

General

This Aluminum-backed flexible prismatic sheeting shall made of Yellow colored flexible prismatic sheeting with non-metallic prismatic lens, formed in a transparent, synthetic resin, as retroreflective elements. This flexible prismatic sheeting shall be of 1ft width and laminated at the back with a 50 micron Aluminum (Al) foil with a pre-coated pressure sensitive adhesive and easily removable liner. Further, this flexible prismatic sheeting shall have screen printed arrow/slant line pattern in black color in a continuous roll format.

This Aluminum-backed flexible prismatic sheeting shall be extremely pliable and easy to bend or wrap around objects. It shall exhibit very high conformability and non-returning dead-fold characteristics required for application on rough and uneven surfaces.

Adhesion for application

This Aluminum-backed flexible prismatic sheeting, with the liner removed, shall be applied with a Neoprene high performance contact adhesive with Polychloroprene base, viscosity of 200-450 cps and solid content of 20-30% for better adhesion.

Edge sealing for protection

After application, the edges of Aluminum-backed flexible prismatic sheeting shall be sealed all around with a two part epoxy based structural adhesive, with epoxy having viscosity of 8000-14000 mPa.s when measured as per ISO 12058, so that it becomes extremely difficult to peel off.

III. Performance requirements

D. Flexibility- wrap around

Both the product specified herein as well as the flexible prismatic reflective sheeting shall be flexible enough to show no cracking when conditioned for 24 hours at 0° C and wrapped and bent around a 1/8 inch mandrel in one second's time with the liners removed.

B. Retroreflection

This flexible prismatic reflective sheeting used in the product specified herein shall be of yellow color and have minimum values co-efficient of retroreflection, when determined in accordance with ASTM E-810, be as per Table I given below and shall conform to ASTM D4956-09, Type VI specifications for reboundable devices

TABLE I Minimum Coefficient of Retroreflection (Candelas Per Lux Per Square Meter)		
Observation Angle°	Entrance Angle°	Yellow
0.2	- 4	400
0.2	+ 30	220
0.5	- 4	100
0.5	+ 30	45

E. Impact Resistance

Retroreflective sheeting shall show no cracking or de-lamination outside of the actual area of impact when subjected to the impact test in accordance with S2.2.1 of ASTM D4956-09.

F. Measurements for Payment

The payment shall be made **on per Square Meter** basis.

G. Rate

The Contract unit rate shall be payment in full for the cost of application, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications

Item no :-38

Chevron sign :-Providing and fixing sign boards made out of 1.5mm aluminium sheet / 3mm ACP (Aluminum composite Panel); size 60x50 cm as per design of IRC-67-2012. Pre treated with phosphating process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint ;reflectorised with Micro Prismatic Grade retro reflectivesheeting of Type-11 as per ASTM D-4956 and latest M.O.S.T.Specifications; 3.3 mtr long stand post of 75 x 75 x 6mm / 65NB Circular MS Pipe as required and frame fabricated from suitable size iron angle of 50 x 50 x 5mm; painted with bestquality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge.The fixing at site shall be in 1:2:4 CC blockof size 45 x 45 x 60 Cms. for each leg.including excavation, curing etc.complete under the supervision of engineer in charge. A warranty for 10 years for the Retro reflective sheeting from originaa manufacturer & a certified copy of 3 year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class-C Type-11 Retro Reflective sheeting

11. Material & Manufacturing:

1.31 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.32 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.32.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.32.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.32.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.32.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.32.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

<i>Sl No.</i>	<i>Description</i>	<i>Specification for 4mm</i>		<i>Specification for 3mm</i>
		<i>Standard test</i>	<i>Acceptable value</i>	<i>Acceptable value</i>
A	<i>Mechanical Properties of ACM</i>			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	<i>Properties of Aluminium Skin</i>			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.32.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.32.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.33 Traffic signs having Retro Reflective Sheeting

1.33.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.33.2 High Intensity Grade Sheeting

1.33.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values

of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.33.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for

Type IV High Intensity Micro-prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow -	Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300	
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135	
0.2°	-4°	700	525	265	70	105	32	21	560	420	210	
0.2°	+30°	325	245	120	33	49	15	10	260	200	95	
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75	
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35	

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	

0.5°	-4°	240	180	90	24	48	11	190	145	72
0.5°	+30°	135	100	50	14	27	6	110	81	41
1.0°	-4°	80	60	30	8	16	3.6	64	48	24
1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A				
Colour	1	2	3	4

	X	y	x	y	X	y	x	y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage , flexibility, liner removal , adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item no :-39

Providing and fixing retro Reflective Prismatic grade Board using 2mm Aluminum / 4mm ACP, angle iron 75 x 75 x 6mm. Descaling and degreasing the board as per requirement using epoxyprimer epoxy paint and carrying retro reflective process by screen painting as directed etc. complete including transporting and fixing in C.C. 1:2:4 with necessary excavation curing etc. complete as per I.R.C 67-2012 design. A warranty for 10 years for the Retro reflective sheeting from original manufacturer & a certified copy of 3

year outdoor exposure test report from third party test lab for the product offered shall be submitted by contractor. (A) Class -C Type-11 retro reflective sheeting

12. Material & Manufacturing:

1.34 Scope

The work shall consist of fabrication, supply and installation of ground mounted traffic signs on roads. The details of the signs shall be as shown in the drawings and in conformity with the code of practice for Road signs, IRC 67-2012.

1.35 Materials

The various materials and fabrication of the traffic signs shall conform to the following requirements:

1.35.1 Concrete:

Concrete for the foundation shall be of M15 Grade as per section 1700 or the grade shown on the drawings or otherwise as directed by the Engineer.

1.35.2 Reinforcing Steel

Reinforcing steel shall conform to the requirements of IS: 1786 unless otherwise shown on the drawings

1.35.3 Bolts, Nuts and Washers

High strength Bolts shall conform to IS: 1367 whereas precision bolts, nuts, etc. shall conform to IS: 1364

1.35.4 Plates and Supports

Plates and support sections for the sign posts shall conform to IS: 226 and IS: 2062 or any other relevant IS specifications.

1.35.5 Substrate

Sign panel shall be fabricated on Aluminum sheet, aluminum composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistance aluminum alloy conforming to IS: 736-Material Designation 24345 or 1900. Aluminum composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 3mm or 4mm (as specified in the contract), and aluminum skin thickness 0.5mm and 0.3mm respectively on both the sides.

The mechanical proportion of ACM and that of aluminum skin shall conform to the requirements given in the table 800-1, when tested in accordance with the test methods mentioned against each of them.

Table 800-1: Specifications for Aluminum Composite Material (ACM)

SI No.	Description	Specification for 4mm		Specification for 3mm
		Standard test	Acceptable value	Acceptable value
A	Mechanical Properties of ACM			
1	Peel off strength with retro reflective sheeting. (Drum Peel Test)	ASTM D903	Min. 4 N/mm	Min. 4 N/mm
2	Tensile strength	ASTM E8	Min. 40 N/mm ²	Min. 30 N/mm ²
3	0.2% Proof Stress	ASTM E8	Min. 34 N/mm ²	Min. 34 N/mm ²
4	Elongation	ASTM E8	Min. 6 %	Min. 5 %
5	Flexural strength	ASTM C393	Min. 130 N/mm ²	Min. 120 N/mm ²
6	Shear strength with Punch shear test	ASTM D732	Min. 18 N/mm ²	Min. 18 N/mm ²
B	Properties of Aluminium Skin			
1	Tensile strength (Rm)	ASTM E8	Min. 150 N/mm ²	Min. 130 N/mm ²
2	Modulus of elasticity	ASTM E8	Min. 70,000 N/mm ²	Min. 70,000 N/mm ²
3	Elongation	ASTM E8	A ₅₀ Min. 2%	A ₅₀ Min. 2%
4	0.2 % Proof Stress	ASTM E8	Min. 110 N/mm ²	Min. 110 N/mm ²

1.35.6 Plate Thickness

Shoulder mounted ground signs with a maximum side dimension not exceeding 600 mm shall not be less than 1.5mm thick Aluminum and 3 mm thick with Aluminium Composite Material. All other signs shall be at least 2mm thick Aluminum and 4 mm thick with Aluminium Composite Material. The thickness of the sheet shall be related to the size of the sign and its support and shall be such that it does not bend or deform under prevailing wind and other loads.

1.35.7 In respect of sign sizes not covered by IRC-67, the structural details (thickness etc.) shall be as per the approved drawings or as directed by the Engineer.

1.36 Traffic signs having Retro Reflective Sheeting

1.36.1 General Requirements

The retro reflective sheeting used on the signs shall consist of white or coloured sheeting having a smooth outer surface, which has the property of retro reflection over its entire surface. It shall be weather resistant and exhibit colour fastness. It shall be new and unused and show no evidence of cracking, scaling, and pitting, blistering, edge lifting or curling and shall have negligible shrinkage or expansion. A certificate of having the sheeting tested for coefficient of retro reflection, daytime colour and luminance, shrinkage, flexibility, liner removal, adhesion, impact resistance, specular gloss and fungus resistance, 3 years outdoor weathering and its having passed these tests shall be obtained from International/Government laboratory/Institute by the manufacturer of the sheeting. The reflective sheeting shall be either of Engineering Grade material with enclosed lens, High Intensity Grade with encapsulated lens or Micro-Prismatic Grade retro reflective element material as given in Clauses 801.3.2 to 801.3.7. Guidance on the recommended application of each class of sheeting may be taken from IRC-67.

1.36.2 High Intensity Grade Sheeting

1.36.2.1 High Intensity Grade (Type III)

This sheeting shall be of encapsulated lens type consisting of spherical glass lens, elements adhered to a synthetic resin and encapsulated by a flexible, transparent water-proof plastic having a smooth surface or as an unmetallised micro prismatic reflective material elements. The retro-reflective surface after cleaning with soap and water and in dry condition shall have the minimum coefficient of retro-reflection (determined with ASTM D:4956-09) as indicated in Table 800-2.

**Table 800-2 Acceptable Minimum Coefficient of Retro-reflection for Type III High Intensity Grade Sheeting^A
(Encapsulated Lens Type)**

(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown
0.1° ^B	-4°	300	200	120	54	54	24	14
0.1° ^B	+30°	180	120	72	32	32	14	10
0.2°	-4°	250	170	100	45	45	20	12
0.2°	+30°	150	100	60	25	25	11	8.5
0.5°	-4°	95	62	30	15	15	7.5	5.0
0.5°	+30°	65	45	25	10	10	5.0	3.5

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent, of the values of retro reflectance indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.36.2.2 High Intensity Micro-Prismatic Grade Sheeting (HIP) (Type IV) :

This sheeting shall be of high intensity retro-reflective sheeting made of micro-prismatic retro-reflective element material coated with pressure sensitive adhesive. The retro-reflective surface after cleaning with soap and water

and in dry condition shall have the minimum co-efficient of retro-reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-3.

**Table 800-3 Acceptable Minimum Coefficient of Retro-Reflection for
Type IV High Intensity Micro-prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	500	380	200	70	90	42	25	400	300	150	
0.1° ^B	+30°	240	175	94	32	42	20	12	185	140	70	
0.2°	-4°	360	270	145	50	65	30	18	290	220	105	
0.2°	+30°	170	135	68	25	30	14	8.5	135	100	50	
0.5°	-4°	150	110	60	21	27	13	7.5	120	90	45	
0.5°	+30°	72	54	28	10	13	6	3.5	55	40	22	

^A Minimum Coefficient of Retro reflection (R_A)(cd.lx⁻¹.m⁻²).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 7 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4 Prismatic Grade Sheeting

1.3.4.1 Prismatic Grade Sheeting (Type VIII)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D: 4956-09) as indicated in Table 800-4

**Table 800-4 Acceptable Minimum Coefficient of Retro-reflection for Type VIII Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)**

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Brown	Yellow - Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent

0.1° ^B	-4°	1000	750	375	100	150	45	30	800	600	300
0.1° ^B	+30°	460	345	175	46	69	21	14	370	280	135
0.2°	-4°	700	525	265	70	105	32	21	560	420	210
0.2°	+30°	325	245	120	33	49	15	10	260	200	95
0.5°	-4°	250	190	94	25	38	11	7.5	200	150	75
0.5°	+30°	115	86	43	12	17	5	3.5	92	69	35

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance

1.3.4.2 Prismatic Grade Sheeting (Type IX)

The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-5

Table 800-5 Acceptable Minimum Coefficient of Retro-reflection for Type IX Prismatic Grade Sheeting^A
(Candelas Per Lux Per Square Metre)

Observation Angle	Entrance Angle	White	Yellow	Orange	Green	Red	Blue	Fluorescent Yellow-Green	Fluorescent Yellow	Fluorescent Orange	Fluorescent
0.1° ^B	-4°	660	500	250	66	130	30	530	400	200	
0.1° ^B	+30°	370	280	140	37	74	17	300	220	110	
0.2°	-4°	380	285	145	38	76	17	300	230	115	
0.2°	+30°	215	162	82	22	43	10	170	130	65	
0.5°	-4°	240	180	90	24	48	11	190	145	72	
0.5°	+30°	135	100	50	14	27	6	110	81	41	
1.0°	-4°	80	60	30	8	16	3.6	64	48	24	

1.0°	+30°	45	34	17	4.5	9.0	2	36	27	14
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^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.4.3 Prismatic Grade Sheeting (Type XI)

Retro reflective sheeting typically manufactured as a cube corner. The reflective sheeting shall be retro reflective sheeting made of micro prismatic retro reflective material. The retro reflective surface, after cleaning with soap and water and in dry condition shall have the minimum co-efficient of retro reflection (determined in accordance with ASTM D 4956-09) as indicated in Table 800-6

Table 800-6 Acceptable Minimum Coefficient of Retro-reflection for Type XI Prismatic Grade Sheeting^A (Candelas per Lux per Square Metre)

Angle Observation	Entrance Angle	white	Yellow	Orange	Green	Red	Blue	Brown	Florescent yellow-Green	Florescent yellow	Florescent
0.1° ^B	-4°	830	620	290	83	125	37	25	660	500	250
0.1° ^B	+30°	325	245	115	33	50	15	10	260	200	100
0.2°	-4°	580	435	200	58	87	26	17	460	350	175
0.2°	+30°	220	165	77	22	33	10	7	180	130	66
0.5°	-4°	420	315	150	42	63	19	13	340	250	125
0.5°	+30°	150	110	53	15	23	7	5	120	90	45
1.0°	-4°	120	90	42	12	18	5	4	96	72	36
1.0°	+30°	45	34	16	5	7	2	1	36	27	14

^A Minimum Coefficient of Retro reflection (R_A) ($\text{cd.lx}^{-1}.\text{m}^{-2}$).

^B Values for 0.1° observation angles are supplementary requirements that shall apply only when specified by the purchaser in the contract or order. When totally wet, the sheeting shall show not less than 90 percent of the values, of retro reflection indicated in above Table. At the end of 10 years, the sheeting shall retain at least 80 percent of its original retro-reflectance.

1.3.5 Adhesive

The sheeting shall have a pressure-sensitive adhesive of the aggressive-tack type requiring no heat, solvent or other preparation for adhesion to a smooth clean surface, in a manner recommended by the sheeting manufacturer. The adhesive shall be protected by an easily removable liner (removable by peeling without soaking in water or other solvent) and shall be suitable for the type of material of the base plate used for the sign. The adhesive shall form a durable bond to smooth, corrosion and weather resistant surface of the base plate such that it shall not be possible to remove the sheeting from the sign base in one piece by use of sharp instrument. The sheeting shall be applied in accordance with the manufacturer's specifications.

1.3.6 Fabrication

Surface to be reflectorised shall be effectively prepared to receive the retro-reflective sheeting. The aluminium sheeting shall be de-greased either by acid or hot alkaline etching and all scale/dust removed to obtain a smooth plain surface before the application of retro-reflective sheeting. If the surface is rough, approved surface primer may be used. After cleaning, metal shall not be handled, except by suitable device or clean canvas gloves, between all cleaning and preparation operation and application of reflective sheeting/primer. There shall be no opportunity for metal to come in contact with grease, oil or other contaminants prior to the application of retro-reflective sheeting. Complete sheets of the material shall be used on the signs except where it is unavoidable. At splices, sheeting with pressure-sensitive adhesives shall be overlapped not less than 5 mm. Where screen printing with transparent colours is proposed, only butt joint shall be used. The material shall cover the sign surface evenly and shall be free from twists, cracks and folds. Cut-outs to produce legends and borders shall be bonded with the sheeting in the manner specified by the manufacturer.

1.3.7 Message / Border

The messages (legends, letters, numerals, etc.) and borders shall either be screen-printed or of cut out from durable transparent overlay or cut out from the same type of reflective sheeting for the cautionary/mandatory sign boards. Screen printing shall be processed and finished with materials and in a manner specified by the sheeting manufacturer. For the informative and other sign boards, the messages (legends, letters, numerals etc.) and borders shall be cut out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer. For screen-printed transparent coloured areas on white sheeting, the co-efficient of retro-reflection shall not be less than 50 per cent of the corresponding values in Tables 800-2 to 800-6 as applicable. Cut-out messages and borders, wherever used, shall be either made out of retro-reflective sheeting or made out of durable transparent overlay except those in black which shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

1.3.8 Color for Signs

1.3.8.1 Signs shall be provided with retro-reflective sheeting and/or overlay film/screening ink as shown on the detailed drawings. The reverse side of all signs shall be painted grey

Table 8.1 Specification Limits (Daytime)^A								
Colour	1		2		3		4	
	X	y	x	y	X	y	x	y

White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green^B	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Blue^B	0.140	0.035	0.244	0.210	0.190	0.255	0.065	0.216
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.610	0.390	0.550	0.450	0.430	0.390
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355

1.3.8.2 Except in the case of railway level crossing signs (for which the colour scheme is given later) the sign posts shall be painted in 250 mm wide bands, alternately black and white. The lowest band next to the ground shall be in black

1.3.8.3 The colour of the material shall be located within the area defined by the chromaticity coordinates in Table 8.1 and comply with the luminance factor given in Table 800-7 when measured as per ASTM D: 4956-09

The colours shall be durable and uniform in acceptable hue when viewed in day light or under normal headlights at night.

1.3.8.4 The mandatory and warning signs shall be provided with white background and red border. The legend/symbol for these signs shall be in black

1.3.8.5 The colours chosen for informatory or guide signs shall be distinct for different categories of roads. For National Highways and State Highways, these signs shall be of green background with white borders, legends and word messages. For Expressways these signs shall be of blue background with white border, legends and word messages.

1.3.9 Refurbishments

Where existing signs are specified for refurbishments, the sheeting shall have semi-rigid aluminum backing or materials as per clause 1.2.5, pre-coated with aggressive tack type pressure sensitive adhesive. The adhesive shall be suitable for the type of material used for the signs and should thoroughly bond with that material.

1.3.10 Sizes of Letters

1.3.10.1 Letter size should be chosen with due regard to the speed, classification and location of the road, so that the sign is of adequate size for legibility but without being too large or obtrusive. The size of the letter, in terms of x-height, to be chosen as per the design speed is given in Table 800-8.

Table 800-8 Acceptable Limits for Size of Letters and Visibility Distance

Design Speed (kmph)	Minimum 'x' Height of the Letters (mm)	Minimum Sight Distance / Clear visibility distance (m)	Maximum Distance from Centre Line (m)
40	100	45	12
50	125	50	14
65	150	60	16
80	250	80	21
100	300	90	24
120	400	115	32

The thickness of the letters and their relation to the x-height, the width and the heights are indicated in Table IV (a) of the Annexure-IV to facilitate the design of the informatory signs and definition plates.

1.3.10.2 For advance direction signs on non-urban roads, the letter size ('x' height) should be minimum of 150 mm for National and State Highways and 100 mm for other roads. In case of overhead signs, the size ('X' height) of letters may be minimum 300 mm. Thickness of the letter could be varied from 1/6 to 1/ 5 of the letter 'x' size. The size of the initial uppercase letter shall be 1-1/3 times x-height. In urban areas, letter size shall be 100 mm on all directional signs. For easy and better comprehension, the word messages shall be written in initial upper case letter followed by lower case letters.

1.3.10.3 Letter size on definition plates attached with normal sized signs should be 100 mm or 150 mm. In the case of small signs, it should be 100 mm. Where the message is long, as for instance in "NO PARKING" and "NO STOPPING" signs, the message may be broken with two lines and the size of letters may be varied in the lines so that the definition plate is not too large. The lettering on definition plates will be all in upper case letters.

1.3.11 Warranty and Durability

The Contractor shall obtain from the original manufacturer of the Retro Reflective sheeting for period of ten (10) years warranty for satisfactory field performance including stipulated retro reflectance of Micro-Prismatic sheeting and a Seven years warranty for High Intensity Grade and submit the same to the Engineer. The warranty shall be inclusive of the screen printed or cut out letters/legends and their bonding to the retro reflective sheeting. The contractor shall also furnish LOT numbers and certificate that the signs and material supplied against the assigned work meet all the stipulated requirements and carry the stipulated warranty and the contractor/supplier is the authorized converter of the particular sheeting.

All the signs shall be dated during the fabrication with indelible marking to indicate the start of the warranty. The warranty shall also cover the replacement obligation by the sheeting manufacturer as well as contractor for replacement/repair/restoration of the retro reflective efficiency.

A certificate in original shall be given by the manufacturer of the sheeting that its offered retro-reflective sheeting has been tested for various parameters such as co-efficient of retro reflection, day/night time color and luminance, shrinkage , flexibility, liner removal , adhesion, impact resistance, specular gloss and fungus resistance.; the tests shall be carried out by a Government laboratory in accordance with the various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters. A copy of the test reports shall be attached with the certificate.

1.4 Installation

1.4.1

The traffic signs shall be mounted on support posts, which may be of GI pipes conforming to IS 1239, Rectangular Hollow Section conforming to IS 4923 or square hollow Section conforming to IS 3589. Sign posts, their foundations and sign mountings shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads or displacement by vandalism. Normally, signs with an area up to 0.9 square metre shall be mounted on a single post, and for greater area, two or more supports shall be provided. Post End(s) shall be firmly fixed to the ground by means of properly designed foundation. The work of foundation shall conform to relevant Specifications as specified.

1.4.2 All components of signs and supports, other than the reflective portion of GI posts shall be thoroughly desealed, cleaned, primed and painted with two coats of epoxy paint. Any part of post below ground shall be painted with protective paint.

1.4.3 The signs shall be fixed to the posts by welding in the case of steel posts and by bolts and washers of suitable size in the case of reinforced concrete or GI posts. After the nuts have been tightened, the tails of the bolts shall be furred over with a hammer to prevent removal.

1.5 Measurement for Payment

The measurements of standard cautionary, mandatory and information signs shall be in number of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by **per Number**

1.6 Rate

The Contract unit rate shall be payment in full for the cost of making the road sign, including all materials, installing it at the site and incidentals to complete the work in accordance with the Specifications.

Item No:-40 Roto road barriers/crash barriers(interlocking & Water fillable) model RMRBDA 2160840 Dimension 2100l X 600(w) X 840X 840(H) mm approx. in red or yellow color.

Item No:-41 Providing and casting in situ ordinary cement concrete M-20 grade for Standard size & Shape of divider stone, Kerbs/Kerb blocks (for footpath & servicetrack) including formwork,curing and finishing etc complete as per

specification and instruction given by site incharge(Kerb stone laid with kerb laying machine)

Casting in situ cement concrete curbing M-20 grade

Scope:-

This work shall consist of constructing cement concrete curb on the road in conformity with the lines, levels and dimensions as specified in the drawings.

Materials :-

Kerb shall be provided in cement concrete of Grade M-200. These shall be cast in situ construction with suitable kerb casting machine in all situations except at locations where continuous casting with equipment is not practicable. In those situations, precast concrete blocks shall be used.

Construction operations:-

Kerb shall be laid on firm foundations of minimum 150mm thk of cement concrete of M200 grade cast in situ or on extended width of pavement.

The foundation shall have a projection of 50 mm beyond the kerb stone. Before laying the foundation of lean concrete the base shall be leveled and slightly watered to make it damp. In the medium portions in the straight reaches the kerb shall be cast in continuous lengths. In the portions where footpath is provided and or the slope of the carriageway is towards median (as in case of super elevated portions) there shall be sufficient gap/recess left in the kerb to facilitate drainage openings.

After laying the kerb and just prior to hardening of the concrete, saw cut grooves shall be provided at 5 m intervals or as specified by the Engineer. Kerb on the drainage ends such as along the footpath or the median in super elevated portions, shall be cast with monolithic concrete as indicated in drawings. The slope of the channel towards drainage pipe shall be ensured for sufficient drainage of the road surface. Vertical and horizontal alignment with respect to true line and level shall be 1:6 mm.

Measurement for payment

Cement concrete kerb shall be measured in cubic meter for the complete item of work. Foundation of central verge, where separately provided shall be measured in cubic meter for completion of work.

Rates

The contract unit rates for cement concrete kerb and foundations for kerb shall be payment in full compensation for furnishing all materials labour, tools, equipments for construction and other incidental cost necessary to complete the work.

Aggregates used for concrete shall consist of naturally occurring stones (crushed or uncrushed) and sand.

Item No:-42 Supplying and fixing of retro-reflective advance warning pavement markers (APM) made out of polycarbonate/ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face with retro reflectance and chromaticity values shall be as given in the detailed specifications and the product shall conform to ASTM D4280 and also meet all the testing conditions of ASTM D4280 and fixed to the road surface using the adhesive recommended by the manufacturer. The length, height and width of the body shall not be less than 150 mm, 10 mm and 90 mm. The marker shall support a load of 20000 Kg tested in accordance with ASTM D4280. Lenses shall be moulded of Polycarbonate or methyl methacrylate conforming to ASTM D788. The area of each retro reflectory surface shall not be less than 13.0 sq.cm. The slope of retro - reflectory surface shall be 25 + 2 degree to base. It should have one cylindrical shaped Shanks of not less than 25 mm diameter and not less than 45 mm length molded with the body for anchorage. Each reflector shall have a CIL not less than values specified in table 1 of MORTH circular dated 11.6.97 respectively.

Item No:-43 Providing and fixing of 750mm x 250mm x 75 mm size speed breakers made up of ABS (Acrylonitrile Butadiene styrene) plastic dark eye/alcolite with interlocking facility U.B. stabilized reflector on either side moulded in PMMA material with ABS base plate through ultrasonic welding process and then fixed on speed bump and these maintain reflecting for longer time. The speed breaker to be fixed on the road with help of epoxy and metallic bolt or as per specified by manufacturer etc. complete. and as per the direction of engineer in charge. Rate is including all fixing labour, loading, unloading, leading and all taxes. The bump is having skid resistance base and combination in yellow and black UV stabilized colors. No digging is permitted on road surface. Nothing extra will be paid whatsoever the case may be. bump

Item No:-44 Spring post :- Supply and figg of Spring post extremely flexible and soft so as not to damage the vehicle the vehicle at collision and to be restored soon at its original. The material of the body should be UV stabilised and non-fading color with 3 bands of high quality of Reflective sheeting of min 50mm. The Height of the post should be 800mm, Top dia of 80mm and base should be 200mm, complete with fixing at site with nails/ anchor fasters as directed by Engineer incharge (Previous tender Approved rate) (RA- AMC)

Item No:-45 Cold Plastic Road Marking Compound with Reflectorizing Glass Beads on Bitumen Surface: Providing and laying Cold Plastic Road Marking Compound material confirming to IRC-35-2015, Clause 2.4, roll on surfacing material a solvent free, high build, two pack, seamless tough, skid resistant, has property of attaining 1.5mm - 2.00mm thickness in single coat application white (or as colored required) based on gloss and colour retaining acrylic cross linking resin system for pedestrian crossing, School, Speed Limit, stop Line, taxi track, cycle track etc on bitumen road as approved by the engineer in charge. Using special roller, wipers, mixing agitator etc. The finished surface to be levelled, uniform and free from oil, grease, dirt, and other foreign material etc

Item NO:-46

Road marking with hot applied thermoplastic paints strictly of Automark - "Specsmark", Asian Paints- "Apcomark", Katalline- "Traffix O" or Berger Paints- "Sigmark" with reflectorising glass beads of Automark- "Autolux Gold", "SwEmpanelmento", "Sovitec" Asian Paints- "Apcobids", "Potters" on bitumen surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is excluding of surface applied glass beds as per IRC:35-2015. The finished surface to be level, uniform and free from streaks and holes. zebra patta /bump patta lane/center line/ edge line/cut patta. The white color marking should provide liminance coefficinet on cemend road shall be min 130 mcd/m2/lux and Asphalt road shall be min 100 mcd/m2/lux during the service life during the day time. The marking should meet the performance criteria for night time reflectivity, wet reflectivity and skid resistance as mentioned in the section-15 of IRC 35-2015. (As per approved R.A)

- ૧) આ કામગીરી M.O.R.T.H ના સ્પેશીફિકેશનને જ થી આવૃત્તિમાં પ્રકરણ ૮૦૩.૪ મુજબ કરવાની રહેશે.
- ૨) સદર કામગીરી ર.પ મી.મી ના જાડાઈમાં કરવાની રહેશે.
- ૩) સદર કામનુ માપ ચો.મી ના પ્રમાણે ચુકવવાનું રહેશે. (gaps બાદ કરતા)

જ) ઇજારદાર દ્વારા મટીરીયલનું MTC રજુકરવાનું રહેશે.તથા IS/MORTH/IRC માં જણાવ્યા મુજબ સેમ્પલીંગ કરી સરકારશ્રીની ગેરી સંસ્થા કે સરકાર માન્ય અન્ય લેબોરેટરીમાં ટેસ્ટીંગકરવાનું રહેશે.
(સીટી એન્જીનીયરશ્રીની કચેરી દફતરી હુકમ/ ૨૦/તા ૩-૨-૧૨)

TECHNICAL DATA

Colour	White and Golden yellow
Composition	
Binder	Min.18%
Glass beads (Intermix)	Min.30%
Tio2(for White)	Min.10%
Fillers (for White)	Min.42%
Softening Point	102.5 ± 9.5* C
Glass beads(Intermix)	Type -1 (MORT & H/BS 6088A)
Yellowness Index (for White)	Not more than 0.12
Drying time	15 minutes Max
Dayligh Luminance @ 45*	
White	Min70%
Yellow	Min.20%
Flow reslstance	Not more than 25%

પ) હયાત સરફેસ ઉપરની ઘુળ, માટી વગેરે પુરેપુરી સ્કેપીંગ કરી સાફ કરવી.

ડ) થર્મોપ્લાસ્ટ પેઇન્ટ ની કામગીરી શરુ કરતા પહેલા અત્રે જાણ કરવાની રહેશે.

ઢ) ઇજારદારશ્રીએ કલરમાં વધારાનું કોઈ પણ મટીરીયલ ઉમેરવાનું રહેશે નહીં.

લ) કલર કામ કરતી વખતે રોડ ઉપર ટ્રાફિકને અડચણરૂપ ન થાય તે મુજબની ચેતવણી બોર્ડ લાવી મુકવાની જવાબદારી ઇજારદારશ્રીની રહેશે. તેમ છતાં ઉપસ્થિત થતી તમામ જવાબદારી ઇજારદારશ્રીની રહેશે.

લ) પટ્ટા લગાડ્યા બાદ જો લગાડેલ પટ્ટા જો યોગ્ય જણાય નહીં તો સ્વખર્ચે ફરીથી કામગીરી કરી આપવાની રહેશે. તેના માટે અલાયદું ચુકવણું કરવામાં આવશે નહીં.

MoRT&H Cluses 803 & Volume II Part II.

General

The colour, width and layout of road markings shall be in accordance with the Code of Practice for

Road Markings with paints, IRC : 35, and as specified in the drawings or as directed by the Engineer.

Materials

Road markings shall be of ordinary road marking paint, hot applied thermoplastic compound, or reflectorised paint as specified in the item and the material shall meet the requirements as specified

below.

Hot Applied Thermoplastic Road Marking

General:

(i) The work under this section consists of marking traffic stripes using a thermoplastic

compound meeting the requirements specified herein.

(ii) The thermoplastic compound shall be screeded/extruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.

(iii) The colour of the compound shall be white or yellow OS colour No. 356) as specified in the drawings or as directed by the Engineer.

(iv) Where the compound is to be applied to cement concrete pavement, a scaling primer is recommended by the manufacturer, shall be applied to the pavement in advance of placing of the stripes to ensure proper bonding of the compound. On new concrete surface any laitance and/or curing compound shall be removed before the markings are applied.

Thermoplastic Material

General : The thermoplastic material shall be homogeneously composed of aggregate, pigment, resins and glass reflectorizing beads.

Requirements

(1) **Composition:** The pigment, beads, and aggregate shall be uniformly dispersed in the resin.

The material shall be free from all skins, dirt and foreign objects and shall comply with requirements indicated in Table 800-3.

TABLE 900-3. PROPORTIONS OF CONSTITUENTS OF MARKING MATERIAL

(Percentage by weight)

Component	White	Yellow
Binder	18.0 min.	18.0 min.
Glass Beads	30-40	30-40
Titanium Dioxide	10.0 min. Calcium	-
Carbonate and Inert Fillers	42.0 max.	See
Yellow Pigments	-	Note

Note Amount of yellow pigment~ calcium carbonate and inert fillers shall be at the option of the manufacturer, provided all other requirements of this Specification are met. (to Properties: The properties of thermoplastic material, when tested in accordance with ASTM D36/BS-3262-(Part 1), shall be as below:

(a) Luminance :

White: Daylight luminance at 45 degrees-65 per cent min. as per AASHTO M 249

Yellow: Daylight luminance at 45 degrees-45 per cent min. as per AASHTO M 249

(b) Drying time : When applied at a temperature specified by the manufacturer and to the required thickness, the material shall set to bear traffic in not more than 15 minutes.

(c) Skid resistance : not less than 45 as per BS 6044.

(d) Cracking resistance at low temperature: The material shall show no cracks on application to concrete blocks.

(e) Softening point 102.5 to 9.50 C as per ASTM D 36.

(1) Flow resistance Not more than 25 per cent as per AASHTO M 249.

(ii) Yellowness Index (for white thermoplastic paint): not more than 0.12 as per AASHTO M 249

(iii) Storage Life : The material shall meet the requirements of these Specifications for a period of one year. The thermoplastic material must also melt uniformly with no evidence of skins or unmelted particles for the one year storage period. Any material not meeting the above requirements shall be replaced by the manufacturer/supplier/Contractor.

(iv) Reflectorisation : Shall be achieved by incorporation of beads. The grading and other properties of the beads shall be as specified in Clause 803.4.3.

(v) Marking : Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:

1. The name, trade mark or other means of identification of manufacturer
2. Batch number
3. Date of manufacture
4. Colour (white or yellow)
5. Maximum application temperature and maximum safe beating temperature.

(vi) Sampling and testing: The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall furnish to the Employer a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification.

Reflectorising glass beads

General : This Specification covers two types of glass beads to be used for the production of reflectorised pavement markings.

Type I beads -are those which are a constituent of the basic thermoplastic compound vide Table 800-3 and Type 2 beads are those which are to be sprayed on the surface vide Clause 803.6.3. The glass beads shall be transparent, colourless and free from milkiness, dark particles and excessive air inclusions. These shall conform to the requirements spelt out in Clause 803.4.3.3.

Specific requirements

Gradation: The glass beads shall meet the gradation requirements for the two types as given in

Table 8W-4.

TABLE 800-4. GRADATION REQUIREMENTS FOR GLASS BEAD

Per cent retained	Type I	Type II
Sieve size	1.18 mm 0 to 3	
850 micron	5 to 20	0 to 5
600 -do-	5 to 20	
425 -do-	65 to 95	
300 -do-	30 to 75	
180 -do-	0 to 10	10 to 30
below 180 micron	0 to 15	

B. Roundness: The glass beads shall have a minimum of 70 per cent true spheres.

C. Refractive index: The glass beads. shall have a minimum refi-Active index of 1.50.

A Free flowing properties: The glass beads shall be free of hard lumps and clusters and shall

dispense readily under any conditions suitable for paint striping. They shall pass the free flow-test.

Test methods: The specific requirements shall be tested with the following methods:

(i) Free-flow test: Spread 100 grams of beads evenly in a 100 mm diameter glass dish. Placethe (fish in a 250 nun inside diameter desiccator which is filled within 25 mm of the top of adesiccator plate with sulphuric acid water solution (specific gravity 1. 10). Cover thedesiccator and lot it stud for 4 hours at 20 to 29 degree C. Remove sample from desiccator,transfer beads to a pan and inspect for lumps or clusters. Then pour beads into a clean, dryglass funnel having a 100 nun stem and 6 nun orifice. If necessary, initiate flow by lightlytapping the funnel. 1"he glass spheres shall be essentially free of lumps and clusters andshall flow freely through the funnel.

(ii) The requirements of gradation, roundness and refractive index of glass beads and theamount of glass beads in the compound shall be tested as per BS 6088 and BS 3262 (Part 1).

(iii) The Contractor shall fumish to the Employer a copy of certified test reports from themanufacturer of glass beads obtained from a reputed laboratory showing results of alltests'specified herein and shall certify that the material meets all requirements of thisSpecification. However, if so required. these tests may be carried out as directed by theEngineer.

Application properties of thermoplastic material

The thermoplastic material shall readily get screeded/ extruded at temperatures specified by the manufacturers for respective method of application to produce a line of specified thickness which shall be continuous and uniform in shape having clear and sharp edges.

The material upon heating to application temperatures shall not exude fumes, which are toxic, obnoxious or injurious to persons_ or property.

Preparation:

- (i) The material shall be melted in accordance with the manufacturer's instructions in a heaterfitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material toavoid local overheating. The temperature of the mass shall be within the range specified bythe manufacturer, and shall on no account be allowed to exceed the maximum temperaturestated by the manufacturer. 7be molten material should be used as expeditiously as possibleand for thermoplastic material which has natural binders or is otherwise sensitive toprolonged heating, the material shall not be maintained in a molten condition forAore than 4hours.

- (ii) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

Properties of finished road marking

- (a) The stripe shall not be slippery when wet.
- (b) The marking shall not lift from the pavement in Freezing weather.
- (c) After application and proper drying, the stripe shall show no appreciable deformation or discolouration under traffic and under road temperatures upto 600C.
- (d) The marking shall not deteriorate by contact with sodium chloride, calcium chloride or oil drippings from traffic.
- (e) The stripe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movement with the road surface without chopping Or cracking.
- (f) The color of yellow marking shall conform to IS Color No. 356 as given in IS: 164.

Reflectorised Paint

Reflectorized paint, if used, shall conform to the Specification by the manufacturers and approved by the Engineer. Reflectorized glass beads for reflectorizing paints where used shall conform to the requirement of Clause 803.4.3.

Application

Marking shall be done by machine. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

The thermoplastic material shall be applied hot either by screeding or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine. The pavement temperature shall not be less than 10°C during application. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the paint. The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall so bond itself to the old line that no splitting or separation takes place. Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed. In addition to the beads included in the material, a further quantity of glass beads of Type 2, conforming to the above noted Specification shall be sprayed uniformly into a mono-layer on to the hot paint line in quick succession of the paint spraying operation. The glass beads shall be applied at the rate of 250 grams per square metre area. The minimum thickness specified is exclusive of surface applied glass beads. The method of thickness measurement shall be in accordance with Appendices B and C of BS - 3262 (Part 3). The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

Measurements for Payment

The painted markings shall be measured in sq. meters of actual area marked (excluding the gaps, if any) In respect of markings like directional arrows and lettering, etc., the measurement shall be by numbers.

Rate

The Contract unit rate for road markings shall be payment in full compensation for furnishing a labour, materials, tools, equipment, including all incidental costs necessary for carrying out the work at the site conforming to these Specifications complete as per the approved drawing(s) or as directed by the Engineer and all other incidental costs necessary to complete the work to these Specifications.

Item NO :-47 Providing and laying Road marking with hot applied thermoplastic paints strictly of Automark "Specsmark", Asian Paints-"Apcomark", Katalline- "Traffix O" or Berger Paints-"Sigmark" with reflectorising glass beads of Automark-"Autolux Gold", "Swarco", "Sovitec" Asian Paints-Apcobids", "Potters" on bitumin surface providing and laying a hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250gms per sqm area, thickness of 2.5mm is exclusive of surface applied glass beds as per IRC:35. The finished surface to be level, uniform and free from streaks and holes.) Directional Arrow, Lettering (1 word up to 4 letters), or any kind of Artwork etc. (which shall maximum size upto 2.75 Sqmt out to out) Item shall include providing Stencils for lettering, direction arrow signages, and as per requirement. including cleaning, required maintenance, etc. complete pre and post work. Cost shall also include laying with applicator machine & operating boilers, Skilled Labours for road marking, and Un-Skilled labours for barricading/protection, traffic diversion, and it shall also include wastage of material, etc. Contractor shall be responsible to run his own thermoplastic applicator machine & supply necessary diesel, gas, fuel, etc, also it will be his responsibility to Operate preheater. for good quality of workmanship as instructed by Engg-in-charge. Agency has to quote rate on Nos. work basis which shall include following manpower and machinery for each set). (AMC As per approved R.A 2025)

TEST SCHEDULE

Sr.No.	Materials	Code of Practice	Onsite / Laboratory	Name of Laboratory Test	Reference Table	Frequency of Test																																																	
1	2	3	4	5	6	7																																																	
1	Retro Reflective Sheeting for the Signage	IRC 67: 2012; ASTM D-4956	On Site Testing with Reflectometer make: Delta, Zehntner, Roadvista – complying to ASTM D 4956	Co-efficient of Retro Reflection	<p>Class-B type-4 High Intensity Grade</p> <table border="1"> <thead> <tr> <th>Observation Angle</th><th>Entrance Angle</th><th>White</th><th>Yellow</th><th>Green</th><th>Red</th><th>Blue</th></tr> </thead> <tbody> <tr> <td>0.1°^B</td><td>-4°</td><td>500</td><td>380</td><td>70</td><td>90</td><td>42</td></tr> <tr> <td>0.1°^B</td><td>+30°</td><td>240</td><td>175</td><td>32</td><td>42</td><td>20</td></tr> <tr> <td>0.2°</td><td>-4°</td><td>360</td><td>270</td><td>50</td><td>65</td><td>30</td></tr> <tr> <td>0.2°</td><td>+30°</td><td>170</td><td>135</td><td>25</td><td>30</td><td>14</td></tr> <tr> <td>0.5°</td><td>-4°</td><td>150</td><td>110</td><td>21</td><td>27</td><td>13</td></tr> <tr> <td>0.5°</td><td>+30°</td><td>72</td><td>54</td><td>10</td><td>13</td><td>6</td></tr> </tbody> </table>	Observation Angle	Entrance Angle	White	Yellow	Green	Red	Blue	0.1° ^B	-4°	500	380	70	90	42	0.1° ^B	+30°	240	175	32	42	20	0.2°	-4°	360	270	50	65	30	0.2°	+30°	170	135	25	30	14	0.5°	-4°	150	110	21	27	13	0.5°	+30°	72	54	10	13	6	3 Readings for 10 Boards for each color
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					<p>Class-C Type-11 Micro Prismatic Grade</p> <table> <tr> <th>Observation Angle</th><th>Entrance Angle</th><th>White</th><th>Yellow</th><th>Green</th><th>Red</th><th>Blue</th></tr> <tr> <td>0.1°^B</td><td>-4°</td><td>830</td><td>620</td><td>83</td><td>125</td><td>37</td></tr> <tr> <td>0.1°^B</td><td>+30°</td><td>325</td><td>245</td><td>33</td><td>50</td><td>15</td></tr> <tr> <td>0.2°</td><td>-4°</td><td>580</td><td>435</td><td>58</td><td>87</td><td>26</td></tr> <tr> <td>0.2°</td><td>+30°</td><td>220</td><td>165</td><td>22</td><td>33</td><td>10</td></tr> <tr> <td>0.5°</td><td>-4°</td><td>420</td><td>315</td><td>42</td><td>63</td><td>19</td></tr> <tr> <td>0.5°</td><td>+30°</td><td>150</td><td>110</td><td>15</td><td>23</td><td>7</td></tr> <tr> <td>1.0°</td><td>-4°</td><td>120</td><td>90</td><td>12</td><td>18</td><td>5</td></tr> <tr> <td>1.0°</td><td>+30°</td><td>45</td><td>34</td><td>5</td><td>7</td><td>2</td></tr> </table>	Observation Angle	Entrance Angle	White	Yellow	Green	Red	Blue	0.1° ^B	-4°	830	620	83	125	37	0.1° ^B	+30°	325	245	33	50	15	0.2°	-4°	580	435	58	87	26	0.2°	+30°	220	165	22	33	10	0.5°	-4°	420	315	42	63	19	0.5°	+30°	150	110	15	23	7	1.0°	-4°	120	90	12	18	5	1.0°	+30°	45	34	5	7	2	
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2	Road Studs / Cat eyes / RPM (Raised Pavement Marker)	IRC 35:2015; ASTM D4280	Laboratory Testing	Compressive Strength	Compressive Strength (Breaking load) – 13635kgf without breakage	1 Sample for each color per lot/brand																																																															
		IRC 35: 2015; ASTM D4280	Laboratory Testing	Flexural Strength	909kgf without breakage or significant deformation (3.3mm)	1 Sample for each color																																																															
		IRC 35:2015;	Laboratory	Resistance to	No More than 2 radial cracks longer than 6.4mm	1 Sample																																																															

		ASTM D4280	Testing	Lens Cracking, Lens Impact Strength		for each Color																				
		IRC 35: 2015; ASTM D4280	Laboratory Testing	Co-efficient of Luminous Intensity – ASTM D4280	Co-efficient of Luminous Intensity (C.I.L) <table><tr><th>Observation Angle</th><th>Entrance Angle</th><th>White</th><th>Yellow</th><th>Red</th></tr><tr><td>0.2</td><td>0</td><td>279</td><td>167</td><td>70</td></tr><tr><td>0.2</td><td>+20</td><td>112</td><td>67</td><td>28</td></tr><tr><td>0.2</td><td>-20</td><td>112</td><td>67</td><td>28</td></tr></table>	Observation Angle	Entrance Angle	White	Yellow	Red	0.2	0	279	167	70	0.2	+20	112	67	28	0.2	-20	112	67	28	1 Sample for each Color
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3	Hot Applied Thermoplast Road Marking	IRC 35: 2015; Section 800 of MORTH	On Site Testing with Reflectometer	(RL) Retro Reflectivity (mcd/m2/lux	Retro Reflectivity (mcd/m2/lux <table><tr><th>Design Speed</th><th>Initial days) (7</th><th>Min Threshold Level (TL) Upto 2 years</th></tr><tr><td>Upto 65 kmph</td><td>200</td><td>80</td></tr><tr><td>65-100</td><td>250</td><td>120</td></tr></table>	Design Speed	Initial days) (7	Min Threshold Level (TL) Upto 2 years	Upto 65 kmph	200	80	65-100	250	120	5 Readings for every 5 Kilometers											
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		IRC 35:2015; Section 800 of MORTH	Laboratory Testing	Proportions of Constituents of Marking Material	<table><tr><th>Component</th><th>White</th><th>Yellow</th></tr><tr><td>Binder</td><td>18.0 Min</td><td>18.0 Min</td></tr><tr><td>Glass Beads</td><td>30-30</td><td>30-30</td></tr><tr><td>Titanium Dioxide</td><td>10.0 Min</td><td>--</td></tr><tr><td>Calcium Carbonate and Inert Filler</td><td>42.0 Max</td><td>--</td></tr></table>	Component	White	Yellow	Binder	18.0 Min	18.0 Min	Glass Beads	30-30	30-30	Titanium Dioxide	10.0 Min	--	Calcium Carbonate and Inert Filler	42.0 Max	--	1 sample for each color
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Titanium Dioxide	10.0 Min	--																			
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		IRC 35:2015; Section 800 of MORTH	On Site Testing	Skid Resistance	Not less than 45 BPN (British Pendulum Number) as per BS:6044	5 Readings for every 5 Kilometers															

ANNEXURE - A

:: કરારનો નમુનો ::

:: કરાર ::

અમો પક્ષકારો:

૧. વડોદરા મ્યુનિસિપલ કોર્પોરેશન ઠે.ખંડેરાવ માર્કેટ વતી મ્યુનિસિપલ કમિશનરશ્રી વડોદરા જેનો હવે પછી મહાનગરપાલિકા તરીકે ઉલ્લેખ કરાશે (અને તેમના સકસેસ એડમીનીસ્ટ્રેટરશ્રીનો સમાવેશ થાય છે) તથા બીજા પક્ષના

૨.----- એ નામે ધંધો કરતી માલીકી પેઢી જેનું મુખ્ય મથક-----
---- ના માલીક શ્રી -----
----- જેનો હવે પછી ઇજારદાર તરીકે ઉલ્લેખ કરાશે તેમાં તેમના કાયદેસરના વારસો,ટ્રાન્સફરીઝ એસાઇનીઝ એકઝીક્યુટિવ તમામનો સમાવેશ થાય છે. મ્યુનિસિપલ કોર્પોરેશન અને ઇજારદાર વચ્ચે નીચેની વિગતો અને શરતો અંગે/ કરાર કરવામાં આવે છે

વડોદરા મ્યુનિસિપલ કોર્પોરેશનના શાખા દ્વારા----- ના કામે આઈટમેટે ભાવપત્રો મંગાવતા કુલ----- નું જે અદાજી ભાવથી-----
----- ટકા વધુ/ઓછા નું ભાવપત્ર સ્થા.સ.ઠ.અંક-----
તા..... થી ઇજારદારના નામે મંજૂર થયેલ છે. ઉપરોક્ત ઇજારદાર સાથે ભાવપત્ર,સ્પેશીફિકેશન,વર્કઓર્ડર વિગેરે શરતો ઉપરાંત નીચે જણાવેલ શરતો અંગે કરાર કરવામાં આવે છે.

૧. ઇજારદારે ભરેલ ભાવપત્ર સ્પેશીફિકેશન તથા શરતો તથા સદર ઇજારા સબંધીત આનુસંગિક તમામ પત્રો કરારના ભાવ રુપે જ ગણાશે.
૨. આ કામે ઇજારદાર તા.----- થી શરુ કરી દિન----- માં પુરુ કરવાનું છે.ભાવપત્રમાં કામ પુરુ કરવાની દર્શાવેલ મુદતમાં ઇજારદારે ચોક્કસપણે કામ પુરુ કરવું જોઈએ અને ઠરેલી મુદતમાં કામ પુરુ કરવાની ઠરેલી તારીખ પછી જેટલો સમય વધુ થાય તેટલા સમયના પ્રતિ દિન ભાવપત્રની રકમના ૦.૦૫ ટકા પરંતુ વધુમાં વધુ ભાવપત્રની રકમના ૧૦ ટકા સુધીની દંડ (લીકવીડીટી ડેમેજ) ઇજારદારે કોર્પોરેશનને ચુકવવાનો રહેશે.
૩. કામગીરીના વર્ક ઓર્ડર માં જણાવ્યા બાદ કામ શરુ કર્યા અંગે ઇજારદારે દિન-૭ માં લેખીત મ્યુનિસિપલ કોર્પોરેશનને જણાવવું પડશે તે પ્રમાણેનું નહી થયે જણાયેથી કે ત્યારબાદ કામ બંધ / શરુ કરવા અંગેનો લેખીત રીપોર્ટ નહી કરવામાં આવે તો નીચે મુજબનો દંડ લેવામાં આવશે (તા.૧-૪-૦૯ થી અમલમાં મંજૂર થયેલા દરો નીચે મુજબ છે)

૧. ૧ થી ૭ દિવસ રૂ. ૧૦૦૦/-

૨. ૮ થી ૧૫ દિવસ રૂ. ૧૫૦૦/-

૩. ૧૬ થી ૩૦ દિવસ રૂ. ૨૦૦૦/-

૪. ૩૦ થી વધુ દિવસ રૂ. ૫૦૦૦/-

આ મુજબનો દંડ રનિંગ બીલમાંથી લેવામાં આવશે. .

૪. સદર કામે ઇજારદારે ભરેલા ભાવપત્ર તેમજ સદર કામના સંદર્ભ કરેલ બંને પક્ષોએ કરેલ પત્ર વ્યવહાર/તેમજ તમામ દસ્તાવેજી પત્રો આ કરારનો ભાગ ગણવામાં આવશે.
૫. ભરેલ ભાવપત્રની જાણાવેલ શરતો અને સ્પેશીફિકેશન મુજબ કામગીરી કરવાની સંપૂર્ણ જવાબદારી ઇજારદારની રહેશે.
- ૬ સદર ઇજારદારે આ ઇજારા લગતી તેમને સોંપવામાં આવેલી કમગીરી સ્વતંત્ર ઇજારદાર તરીકે (ઇન્ડીપેન્ડન્ટ કોન્ટ્રાક્ટર) કરવાની છે અને સદર કામગીરીના સમય દરમિયાન કામગીરી કરતી વખતે કોઈપણ પ્રકારના અકસ્માત કે નૈસર્ગિક (અકસ્માત) ના કારણે મહાનગર કે અન્ય સરકારી/અર્ધ સરકારી કે ખાનગી જાનમાલને નુકશાન થાય તો એ અંગે નુકશાન/વળતર કે અન્ય જવાબદારીઓ/ખર્ચ બાબતમાં કોઈપણ દાવો ઉપસ્થિત તથા તે અંગેની સંપૂર્ણ જવાબદારી ઇજારદારની રહેશે. આ અંગે મહાનગર સેવાસદનની કોઈપણ જાતની જવાબદારી રહેશે નહીં.
- ૭ આ કરાર કે તેની કોઈપણ શરત અંગે ભવિષ્યમાં કોઈ વિવાદ ઉપસ્થિત થશે તો તેવા વિવાદના ઉકેલ મ્યુનિસિપલ કમિશનર લવાદ તરીકે કરશે ત્યારબાદ જ ઇન્ડિયન આર્બિટ્રેશન એક્ટ ૧૯૪૦ ની જોગવાઈ આ તેમજ વખતો વખત તેમાં થયેલા સુધારા હેઠળની જોગવાઈઓ મુજબ મહાનગર સેવાસદન સોલ આર્બિટ્રેટર તરીકે નીમશે અને તેવા વિવાદનો જે કોઈ નિર્ણય આવશે તે આખરી ગણાશે અને બંને પક્ષકારોને બંધનકર્તા રહેશે.
- ૮ ટેન્ડરની જોગવાઈ પ્રમાણે મટીરીયલનુ ટેસ્ટીંગ કરી રીપોર્ટ રજુ કરવાની જવાબદારી ઇજારદારની પોતાની રહેશે.
- ૯ ઇજારદારે કોન્ટ્રાક્ટ લેબર (રેલુએશન અને એબોલેશન) એક્ટ પ્રોવીડન્ટ ફંડ એક્ટની જોગવાઈઓનુ પાલન કરવાનુ રહેશે. **Minimum Wages Act**, સેફ્ટી એક્ટ કે વખતો વખત મહાનગર સેવાસદન. કે સરકાર દ્વારા લાગુ કરવામાં આવે તેવા કાયદાઓનુ પાલન કરવાની જવાબદારી ઇજારદાર ની રહેશે.
- ૧૦ આ કરાર કે તેની કોઈપણ શરતો અંગે કોઈ વિવાદ ઉપસ્થિત થશે તો મુદ્દા નં.૬ માં જણાવ્યા બાદ નામદાર વડોદરા કોર્ટની હકુમત ને આધીન રહેશે.
- ૧૧ ઇજારદારે સદર કામ લાગતી કોન્ટ્રાક્ટ ઓલ રીક્સ પોલીસી લેવાની રહેશે. અનેતેમાં ચુક કે વિલંબ થાય તો તે અંગેની તમામ જવાબદારી ઇજારદારની રહેશે.
- ૧૨ ઇજારદારે કામગીરીનો વર્ક ઓર્ડર આપ્યા બાદ કે કરાર કર્યા બાદ સ્થળે કામગીરી શરૂ કર્યા બાદ (આ ત્રણ પૈકી જે પ્રથમ થાય) ભરેલ ભાવપત્રની શરતો કે કરારની શરતો કે પત્રો દ્વારા આપેલ સંમતીઓનો ભંગ થાય તો સક્ષમ અધિકારી કે તેના પ્રતિનિધી દ્વારા પ્રાથમિક એક અને વધારેમાં વધારે ત્રણ સુચના આપ્યા બાદ , સુચનાનો અમલ ન થાય તે સંજોગોમાં ઇજારદારને કરેલા કામનું યોગ્ય જણાય તેટલુ ઓછુ ચુકવણુ કે કોઈ પણ ચુકવણુ ન કરવાનુ કે ઇજારદારે ભરેલ તમામ અનામતો જમ કરવાનું કે મહાનગરપાલિકાના કોઈ પણ કામોમાંથી આવી વસુલાત ઇજારદાર પાસેથી કરી શકશે અને આ ઉપરાંત ઇજારદારને કાળી ચાદીમાં મુકી શકશે. /TERMINATE કરી શકશે. કાળી ચાદીમાં મુકીને સરકારશ્રી અર્ધ સરકારી સંસ્થામાં તેમજ

કેન્દ્ર સરકારની કચેરીમાં જાણ કરવામાં આવશે. કાયદાકીય પગલાઓમાં ફોજદારી કાર્યવાહીનો પણ સમાવેશ થાય છે.

૧૩. સદર કામ ઈજારદાર કોઈ કારણસર પુરુ કરવામાં નિષ્ફળ નીવડે તેવા પ્રસંગે કોર્પોરેશન સદર કામગીરી અન્ય ઈજારદાર અથવા સંસ્થા પાસેથી વસુલ કરવા મહાનગર સેવાસદનને તમામ અધીકાર રહેશે તથા મહાનગર સેવાસદનને યોગ્ય જણાયે તો ઈજારદાર દ્વારા ભરેલ તમામ અનામતો જપ્ત કરી શકશે.

૧૪. ઈજારદારે ભાવપત્રકમાં દર્શાવેલ કામગીરી સ્પેસીફિકેશન મુજબ કરવાની રહેશે તેમાં સ્પષ્ટતા ન હોય તો આઈ . એસ. સ્પેસીફિકેશન તથા P.W.D. MANUALS મુજબ કરવાની રહેશે.

૧૫. કામગીરીની પ્રગતિ સમય મર્યાદાને ધ્યાને રાખી કરવાની રહેશે તથા કામગીરી સમય મર્યાદાને ધ્યાને રાખી કરવાની રહેશે તથા કામગીરી સમય મર્યાદામાં પુર્ણ કરવાની રહેશે.

૧૬. ઈજારદારે કામના સ્થળે MOVING ટ્રાફિક તેમજ રાહદારીઓની સલામતી માટે જરૂરી તમામ સંબંધિત પગલા લેવાના રહેશે. રસ્તા, ફૂટપાથ, ડીવાઈડર તથા વરસાદી ગટરના કામ માટે રોડની ઘાતે/જંકશન પર પતરાં/પ્રીકાસ્ટ પેનલ/એમ.એસ. બેરીકેડસ લગાવવાના રહેશે. તથા દિવસે તેમજ રાત્રીના સમયે દેખાય તેવા સાઈનેજીસ/સુચક બોર્ડ / રીફ્લેક્ટર/રેડીયમ લગાવવાના રહેશે. આ માટે કોઈ ઇલાયદા ચુકવણું કરવામાં આવશે નહીં. સ્થળ પરનાં પ્રગતિમાં હોઈ તેવા કામો માટે સુરક્ષા તથા સલામતી અન્યથા ચુક થયેથી અથવા અનિવાર્ય સંજોગોમાં કોઈ અકસ્માત સર્જવાની પરિસ્થિતિએ થતી તમામ વહીવટી તથા કાયદાકીય બાબત અન્યથા ઈજારદારની સંપૂર્ણ જવાબદારી રહેશે,

આ કરાર અમો બંને પક્ષકારોએ વાંચી, સમજી સભાનતામાં કરી આ પી તે અમોને. કબુલ મંજૂર છે.

તારીખ / / ૨૦૨૬

સ્થળ: વડોદરા.

ઈજારદારની સહી..

ઈજારદારની સંસ્થાનું નામ અને સરનામું

૧. નામ સાક્ષી

સરનામું સહી

૨. નામ સાક્ષી

સરનામું સહી

કાર્યપાલક ઈજનેર (રોડ પ્રોજેક્ટ શાખા)

વડોદરા મ્યુનિસિપલ કોર્પોરેશન વતી

ઉપરનું સીલ અમારી રુબરુ લગાડવામાં આવ્યું છે.

વડોદરા મ્યુનિસિપલ કોર્પોરેશન

સ્થાયી સમિતિના સભાસદો.

૧. નામ

સાક્ષી

સરનામું

સહી

૨. નામ

સાક્ષી

સરનામું

સહી

ANNEXURE - B

(Ref. Clause of general condition of contract)

કરેલ કામગીરીનું ચુકવણું કરવા માટે ઇજારદારે રજુ કરવાની વિગત

મુળ ટેન્ડર મુજબ આઈટમ નં.	આઈટમ વિગત	ની	નંબર	લંબાઈ	પોહનાઈ	ઉંડાઈ	જથ્થો	માંગણી ટેન્ડર મુજબ ભાવ

ઉપર મુજબની વિગતો પ્રમાણેની કામગીરી ટેન્ડરની જોગવાઈઓ/સ્પેશીફિકેશન મુજબ અમોએ પુર્ણ કરેલ છે અને તેનું ચુકવણું રનીંગબીલ/ફાઈનલબીલ તરીકે આપવા વિનંતી છે.

તા. / / ૨૦૨૬.

ઇજારદારની સહી.

ઉપરોક્તનું પત્રક / બીલ મુજબ ઇજારદારની બીલ ચુકવણું કરવાની માંગણી આવ્યાબાદ બીલની ચુકવણીની કાર્યવાહી કરવામા આવશે.

ANNEXURE C
On Letter Head of Thermoplastic Road Marking Manufacturer
USAGE CONFORMANCE CERTIFICATE
To be issued after completion of the work

CLIENT NAME:

CONVERTER/APPLICATOR NAME:

CONTRACTOR NAME:

WORK ORDER DETAILS:

Details of thermoplastic road marking painting work carried out using Brand Name of Thermoplastic Road Marking Manufacturer.

Providing and applying hot applied thermoplastic road making @ **2.5mm thick** including reflectorizing glass beads @250 gms per sq.mt area as per IRC:35, **quantity 0000.000 sq.mt and Letters 0000 Nos. up to Date DD-MM-YY.**

Certified that the above hot applied thermoplastic road marking have been carried out using

"Product Name of" thermoplastic material and glass beads (according to ASTM D 36/BS 3236) and are covered by the warranty no XXX dated XX-XX-XXXX

Name of Thermoplastic Road
Marking Manufacturer

Name of Authorised
Converter/Applicator

Authorised Signatory

Authorised Signatory

ANNEXURE D
On Reflective Sheeting Manufacturer's Letter Head
USAGE CONFORMANCE CERTIFICATE

DATE

WARRANTY

CLIENT NAME

CONTRACTOR NAME

WORK ORDER DETAILS

Details of the Signage installed using Name of Brand Reflective sheeting					
Sr. No.	Type of Sign	Size (mm)	Stretch/Project	Type of Sheeting	Nos. of Board

Certified that the above sign board have been manufactured using Brand Name of Sheeting (ASTM D4956) Type-11 and are covered under the Warranty No._____

Name of Sheeting Manufacturer

For Name of Converter

Authorised Signatory

Authorised Signatory

ANNEXURE E
On Cat Eyes/RPM/Road Stud Manufacturer's Letter Head
USAGE CONFORMANCE CERTIFICATE

DATE

WARRANTY

CLIENT NAME

CONVERTER NAME

CONTRACTOR NAME

WORK ORDER DETAILS

Details of Sign Boards installed using Name of **NAME OF MANUFACTURER**

SR. No.

Name of Stretch

Qty Product

Certified that the above RPMs have been manufactured using **NAME OF MANUFACTURER**, and are covered by the Warranty No.

Name of Manufacturer

Name of Converter

Authorised Signatory

Authorised Signatory

ANNEXURE-F

Format for the Performance Guarantee Bond

(Annual Rate Contract For hot applied thermoplastic paint and installing various road furniture in various areas for Traffic department) (Unit Rate)

Where as M/s. _____ have been awarded a contract dated _____ for Annual Rate Contract For The work of bringing and installing different types of traffic fixtures for traffic regulation on the main roads in VMCarea. and.

Where as the said M/s. _____ has appointed us, _____ Bank to provide a PERFORMANCE GUARANTEE bond to the Vadodara Mahanagarpalika for the work undertaken by M/s. _____ and

Where as we, the _____ Bank have agreed to provide the following PERFORMANCE GUARANTEE bond.

Now THEREFORE we the _____ Bank provide the following Performance Bank Guarantee by way of this bond to the VADODARA MUNICIPAL CORPORATION.

1. The contract value of the contract provided that to M/s. _____ by the VADODARA MUNICIPAL CORPORATION is _____. This guarantee in the nature of PERFORMANCE GUARANTEE is provided so as to ensure and indemnify the Vadodara Mahanagarpalika for the full and proper performance of the contract by M/s. _____ the _____ bank hereby indemnify the Vadodara Mahanagarpalika for all losses and/or damages to vmc properties which would be executed by M/s. _____ and such PERFORMANCE GUARANTEE would include any damage to the executed work or its components which may be suffered by the Vadodara Mahanagarpalika, as a result of defective supply and workmanship, or at all by way of this bond.

We the _____ bank agree and promise that in the eventuality of the contractor M/S. _____ not repairing or remedying the problem, loss or damage to the executed work. We shall indemnify and pay the Vadodara Mahanagarpalika, such expenses, losses and damaged that may be incurred by the Vadodara Mahanagarpalika, as a result of the VADODARA MUNICIPAL CORPORATION getting the work done itself or from other source.

2. We _____ bank agree and understand that the decision as to whether any losses or damages to the executed work have taken place or not and/or whether the work suffer from poor workmanship or not will be taken by the Commissioner of Vadodara Mahanagarpalika and on the commissioner's decision regarding such losses or damage or defect whatsoever being so notified by the VADODARA MUNICIPAL CORPORATION to us. We shall immediately take steps and ensure that M/S. -----faithfully and diligently carry out the necessary remedial steps to the full satisfaction of the commissioner of VADODARA MUNICIPAL CORPORATION. The opinion of the commissioner as to whether full and complete remedial steps, to the full satisfaction of the commissioner of Vadodara Mahanagarpalika has been taken or not will be that of the Commissioner of Vadodara Mahanagarpalika. For the purpose of

arriving at such decision as aforesaid, it will be open to the commissioner of Vadodara Mahanagarpalika to take assistance of such technical people as may be available and it will be also open to the commissioner of Vadodara Mahanagarpalika in case he desires, to delegate this power to a subordinate, like City Engineer, to take appropriate decisions and the decisions referred to above will be deemed to be properly taken by the Commissioner of VADODARA MUNICIPAL CORPORATION. In the eventuality of M/s. _____ not taking remedial action to the at most satisfaction of the commissioner of VADODARA MUNICIPAL CORPORATION the Vadodara Mahanagarpalika will be entitled to get the work done itself or from other sources. On the Commissioner of Vadodara Mahanagarpalika notifying to us the total expenses incurred for the purpose we hereby expressly undertake to pay to Vadodara Mahanagarpalika the said amount forthwith and in any case not later than 7 days from such intimation. We shall accept as final and binding the amount indicated by the Commissioner of Vadodara Mahanagarpalika and our obligation to pay such amount will be a continuing obligation irrespective of any dispute or difference that may arise between us and M/s. _____ of between VADODARA MUNICIPAL CORPORATION and M/s. _____.

3. The Contract value is Rs. _____. This PERFORMANCE AND GUARANTEE is limited to 5% of the said contract value and accordingly it comes to Rs. _____. Our liability, in all cases be limited to Rs. _____.
4. We agree and undertake that this PERFORMANCE GUARANTEE will be valid for a period of **1 years** from the date issuance of completion certificate to M/S. _____ or The commissioner of Vadodara Mahanagar palika will notify such completion date to us In case no such completion date if notified, this PERFORMANCE GUARANTEE will come in to effect from such completion date. In case however, the contract consist of several parts, and to simultaneously indicate a break up of the contract value equivalent to the separate parts in which case the PERFORMANCE GUARANTEE to the extent of the different contract value will come into operation on such different completion dates. It is expressly understood that in considering this period of **1 years**, the date by which the Corporation intimate the Bank about the losses, damages or problem as the case may be, shall be considered and as long as such intimation is within a period of **1 years**, from the completion date, we the _____ Bank will be liable irrespective of whether the remedial actions or lack there of has taken place after the period of **1 years**.
5. We _____ Bank agree that the PERFORMANCE GUARANTEE which is a continuing guarantee, will be binding and enforceable against us irrespective of any difference or dispute between Vadodara Mahanagarpalika and M/s. _____ or between us and M/s. _____ and irrespective of any change or variation or extension of time or any forbearance or waiver made or granted by Vadodara Mahanagarpalika to M/s. _____.
6. In case any disputes arises as to the interpretation or implementation of this PERFORMANCE GUARANTEE THE MATTER shall be referred to the sole arbitration of the commissioner of Vadodara Mahanagarpalika, whose decision in the matter will be final. In case any recourse to any court of law is necessitated, the appropriate Civil Court at Vadodara Alone will have jurisdiction.

Vadodara.

Date:-